Second Edition

OXFORD

Fundamentals of Health Psychology

Edited by
Thomas Hadjistavropoulos
& Heather D. Hadjistavropoulos

Fundamentals of Health Psychology

Second Edition

Fundamentals of Health Psychology

Edited by
Thomas Hadjistavropoulos
& Heather D. Hadjistavropoulos

OXFORD
UNIVERSITY PRESS

OXFORD
UNIVERSITY PRESS

Oxford University Press is a department of the University of Oxford.
It furthers the University's objective of excellence in research, scholarship,
and education by publishing worldwide. Oxford is a registered trade mark of
Oxford University Press in the UK and in certain other countries.

Published in Canada by
Oxford University Press
8 Sampson Mews, Suite 204,
Don Mills, Ontario M3C 0H5 Canada

www.oupcanada.com

First Edition published in 2015

Library and Archives Canada Cataloguing in Publication

Fundamentals of health psychology/Thomas Hadjistavropoulos and Heather D.
Hadjistavropoulos.–Second edition.

Includes bibliographical references and index.
Issued in print and electronic formats.
ISBN 978-0-19-902864-1 (hardcover).—ISBN 978-0-19-902868-9 (PDF)

1. Clinical health psychology–Textbooks. 2. Textbooks. I. Hadjistavropoulos,
Thomas, 1963-, editor II. Hadjistavropoulos, Heather D., 1967-, editor

R726.7.F86 2018 616.001'9 C2018-903700-8
C2018-903701-6

Cover image: Jordan Siemens/Getty Images
Cover design: Sherill Chapman
Interior design:Laurie McGregor

Oxford University Press is committed to our environment.
This book is printed on Forest Stewardship Council® certified paper
and comes from responsible sources.

Printed and bound in the United States of America

1 2 3 4 — 21 20 19 18

To our sons, Nicholas and Dimitri.

Thomas Hadjistavropoulos

Heather D. Hadjistavropoulos

Brief Contents

Contents

Preface

It was a pleasure for us to work with the authors and with Oxford University Press on the preparation of a second edition of this important volume. This edition incorporates updated references and information in all of its chapters and features two brand-new chapters. The first of these new chapters focuses on appetitive behaviours (i.e., eating, drinking, smoking, and recreational drug use). The second new chapter incorporates broad information on psychological influences on health as well as general principles of psychological chronic disease management (e.g., coping techniques and psychological interventions to address depression and anxiety that may result from having a chronic illness). This chapter replaces six short chapters that, in the previous edition, covered a variety of very specific health conditions.

This text, most suitable for health psychology courses offered in the United States, Canada, and elsewhere, is unique in many ways. Unlike many university textbooks in the Canadian market, this volume is not a Canadian edition (i.e., an edition with added Canadian content) of a pre-existing US text. We felt that such an approach would not be optimal. Instead, this book was developed from the ground up with the intent of providing both US and Canadian content (e.g., prevalence information for each country, descriptions of the health systems of both countries, emphasis on cultural diversity) in order to be optimally suited for both countries. Given its breadth, the book would also be appropriate for adoption by universities outside North America.

A second strength of this volume is its collection of contributors. Most university texts are written by one to four authors who are not experts in each and every major topic covered. Unlike such texts, chapters in this volume are authored by individuals who are leading experts on the topics covered.

A third strength of the book is that it contains chapters dedicated to special populations and issues (i.e., children, older adults, cross-cultural issues). Most health psychology university textbooks do not include specialized chapters covering these most important areas.

This book was written with advanced (i.e., third- and fourth-year) undergraduate students in mind but would also be appropriate as an introductory health psychology text for more advanced students. It is organized conceptually so that Chapters 1 to 7 cover very general, broad issues as well as common problems that affect both healthy individuals and those with a wide variety of chronic illnesses (e.g., introduction to health psychology, body systems, psychological determinants of health and immunity, stress and health, appetitive behaviors such as eating and drinking, the health-care system and the role of psychologists within that system, and disease prevention and health promotion). In Chapters 8 to 12 the focus shifts to serious chronic health conditions (e.g., cancer, cardiovascular disease, chronic pain, and HIV) as well as to psychological influences on such conditions. Representing one of the most significant strengths of this book, Chapters 13 to 15 are among the most important in the volume. They cover special populations (e.g., children and older adults) as well as cross-cultural issues. Study of the issues affecting these populations are of critical importance within our pluralistic society.

We hope that you will enjoy this book and that it will kindle your interest to learn more about health psychology.

Thomas Hadjistavropoulos, Ph.D., ABPP, FCAHS
Heather D. Hadjistavropoulos, Ph.D.
Editors

From the Publisher

Oxford University Press is pleased to present the second edition of *Fundamentals of Health Psychology*. Bringing together an internationally respected team of experts, the second edition continues to offer a comprehensive introduction to the key topics and approaches in the fast-growing field of health psychology. Building on the basics, this contributed volume introduces students to general areas of health psychology—such as body systems, health-care systems, stress, and illness prevention—before moving on to examine health conditions, issues affecting special populations, and cross-cultural concerns. Compelling and thought-provoking, *Fundamentals of Health Psychology,* second edition offers students the foundation they need to engage critically with the most pressing issues in health psychology and to pursue future study in this fascinating field.

Important Features of This Book

Fundamentals of Health Psychology, second edition incorporates a number of high-interest features that enhance its value as a reliable, useful, and up-to-date teaching and learning tool:

- **Two new chapters**—one on eating, smoking, and recreational substance use; and the other on chronic health problems—provide coverage of health behaviours and conditions.
- **Distinguished contributors**—hailing from throughout North America offer authoritative and up-to-date insight into the current state of research and collaboration in health psychology.
- **Balanced coverage** of general issues as well as specific conditions and illnesses provides students with a well-rounded understanding of the field.
- **In-depth discussion of special populations** in Part III explores pediatric psychology, geropsychology, and cross-cultural concerns, allowing students to learn about issues and challenges that extend beyond their personal frames of reference.
- **Coverage of the latest research in the field**, including new material on sleep, end-of-life care, and the influence of technology and social media on health, ensures students receive an up-to-date look at this dynamic field.
- **Two types of themed boxes** highlight significant issues, theories, and practice-based solutions.
  - prevention, research, and treatment.
  - **"In Practice" boxes** present students with case studies and show how health psychologists apply theories to explain and solve health issues.
- **Visually engaging photos, figures, and tables** help students envision and interpret complex concepts and data, bringing the discussion to life.
- **"Future Directions" discussions** explore where current research and treatments may lead, providing highly relevant insight to students considering a career in the field.
- **End-of-chapter summaries, questions for critical thought, and reading lists** improve student comprehension and encourage active engagement with key concepts.

Online Supplements

Fundamentals of Health Psychology, second edition is supported by an outstanding array of ancillary materials, including a **test bank**, **PowerPoint slides**, and a **brand-new video guide** for instructors as well as a **study guide** and **practice quizzes** for students. These resources are available online at **www.oupcanada.com/HealthPsychology2e**.

Acknowledgements

We express our sincere gratitude to all of our distinguished chapter contributors for their work and to Rhonda Stopyn for her assistance with the formatting and organisation of the manuscript. We also grateful to Rhiannon Wong and Dave Ward of Oxford University Press, Canada for encouraging and facilitating this work.

The editors, along with Oxford University Press, would like to acknowledge the reviewers whose thoughtful comments and suggestions have helped to shape this text:

Theresa Bianco, Concordia University
Christopher Ashley Cooper, University of Saskatchewan
Ken Fowler, Memorial University of Newfoundland
Sylvette La Touche-Howard, University of Maryland, College Park
Shelley Delano Parker, University of New Brunswick
Gabrielle Rigney, Dalhousie University
Elizabeth Russell, Trent University
Hannah Peach Windell, University of North Carolina at Charlotte

Thomas Hadjistavropoulos
Heather Hadjistavropoulos
Editors

About the Editors

Courtesy of University of Regina, Department of Photography

Thomas Hadjistavropoulos, Ph.D., ABPP, FCAHS is Professor of Clinical Psychology, Research Chair in Aging and Health, and Director of the Centre on Aging and Health, University of Regina. He has served as the 2007–8 President of the Canadian Psychological Association (CPA). His research, which has been funded by the Canadian Institutes of Health Research (CIHR), the Saskatchewan Health Research Foundation, the Canada Foundation for Innovation, the AGE WELL Network of National Centres of Excellence, and the Social Sciences and Humanities Research Council of Canada, focuses on psychological issues in pain. An area of recent focus has been pain assessment and management among seniors with a special emphasis on seniors who have severe limitations in ability to communicate because of dementia. He has been honoured with numerous prestigious awards including a CIHR Investigator Award, the Year 2000 Canadian Pain Society Early Career Award for Excellence in Pain Research, the Canadian Association on Gerontology Distinguished Member Award, the Saskatchewan Health Research Foundation Career Achievement Award, a Saskatchewan Health Care Excellence Award, and many others. He has also been elected Fellow of the Canadian Psychological Association as well as of the American Psychological Association in recognition of his distinguished contributions to the science and profession of psychology. More recently, he was inducted as Fellow in the Canadian Academy of Health Sciences, which represents one of the highest honours available to Canadian health scientists. Thomas is Editor-in-Chief of Ethics & Behavior and in the past has served as Editor of *Canadian Psychology/Psychologie canadienne,* Psychology Section Editor of the *Canadian Journal on Aging,* as well as on other editorial boards. He has published over 160 peer-reviewed papers and book chapters as well as five books.

Courtesy of University of Regina, Department of Photography

Heather Hadjistavropoulos (Ph.D. University of British Columbia 1995) is a Professor of Psychology at the University of Regina (U of R), Canada. She founded the Psychology Training Clinic at the U of R in 2002, and trains graduate students in the assessment and treatment of anxiety and mood disorders, commonly among individuals with co-morbid medical conditions. Heather's research is focused on (a) assessing and treating psychological problems that impact health and (b) understanding and improving the quality of health care in an attempt to reduce the burden of illness. Heather received a Canada Innovation Foundation grant to develop a state-of-the-art Clinical Health Psychology research area. She has published and presented her research widely and received funding through the Canadian Institutes of Health Research, Canadian Health Services Research Foundation, and the Saskatchewan Health Research Foundation. She has been the recipient of many awards for her research as well as her contributions to training and the profession of psychology. In 2010, Dr Hadjistavropoulos founded the Online Therapy Unit (onlinetherapyuser.ca). This unit has (1) overseen the development of a website and policies and procedures for the delivery of therapist-assisted Internet-delivered cognitive behavioural therapy (I-CBT) in Saskatchewan; (2) trained community providers and graduate students on how to use I-CBT; and (3) co-ordinated, monitored, and evaluated the delivery of I-CBT for multiple conditions. The Online Therapy Unit is having a substantive impact on delivery of psychological care in Saskatchewan and inspiring the development of similar services in other provinces.

Contributors

Rebecca S. Allen, Ph.D., ABPP
University of Alabama

Casey B. Azuero, Ph.D., M.P.H
University of Alabama at Birmingham

Christine T. Chambers, Ph.D.
Dalhousie University

Nicholas J.S. Christenfeld, Ph.D.
University of California, San Diego

Eric J. Connors, M.A.
Alliant International University

Blaine Ditto, Ph.D.
McGill University

Michelle M. Gagnon, Ph.D.
University of Saskatchewan

Sherry L. Grace, Ph.D.
York University & University Health Network, Toronto

Heather D. Hadjistavropoulos, Ph.D.
University of Regina

Thomas Hadjistavropoulos, Ph.D., ABPP, FCAHS
University of Regina

Trevor A. Hart, Ph.D.
Ryerson University & University of Toronto

Stanley Ing, M.P.H.
Chatham-Kent Public Health Unit

Amanda C. Kentner, Ph.D.
Massachusetts College of Pharmacy & Health Sciences

Gerald P. Koocher, Ph.D., ABPP
Quincy College

Adrienne H. Kovacs, Ph.D.
Knight Cardiovascular Institute & Oregon Health & Science University

Britta A. Larsen, Ph.D.
University of California, San Diego

Gregory P. Marchildon, Ph.D, FCAHS
University of Toronto

Swati Mehta, Ph.D.
University of Regina

Anne Moyer, Ph.D.
Stony Brook University

Bojana Petrovic, M.P.H.
University of Toronto

James O. Prochaska, Ph.D.
University of Rhode Island

Janice M. Prochaska, Ph.D.
Pro-Change Behavior Systems, Inc.

Chantelle Richmond, Ph.D.
University of Western Ontario

Arseny A. Ryazanov, M.A.
University of California, San Diego

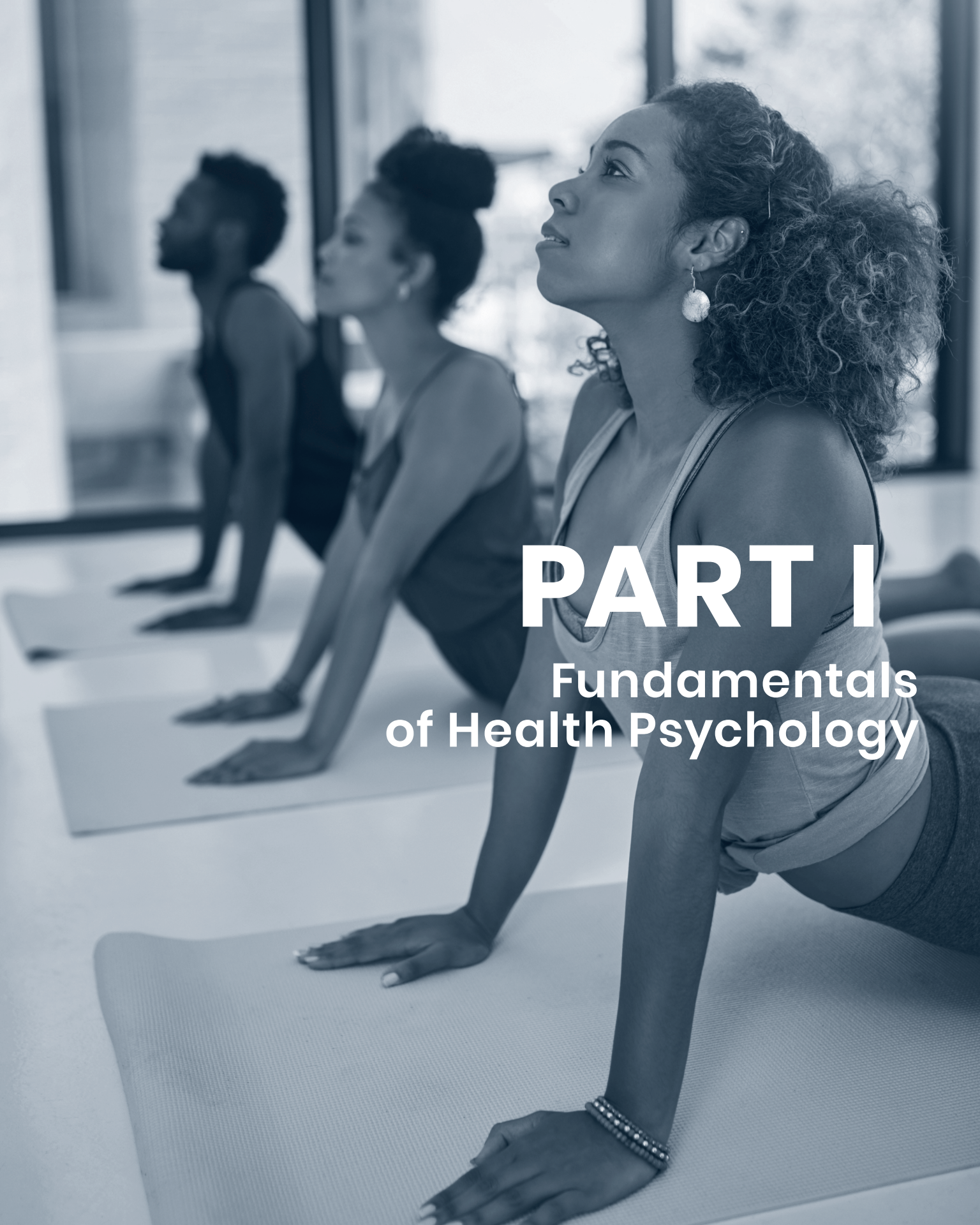
Elizabeth A. Sarma, Ph.D., M.P.H.
National Cancer Institute

Natalie Stratton, M.A.
Ryerson University

Tyler G. Tulloch, M.A.
Ryerson University

Perri R. Tutelman, B.H.Sc.
Dalhousie University

Jaime Williams, Ph.D.
University of Regina



PART I

Fundamentals of Health Psychology

Introduction to Health Psychology

Thomas Hadjistavropoulos
Heather D. Hadjistavropoulos

Learning Objectives

In this chapter you will:

- Learn what health psychology and behavioural medicine are.
- Read a brief history of health psychology from its roots in ancient Greece to the tremendous growth the field has experienced in recent years.
- Find out about careers in health psychology (e.g., research vs clinical positions).
- Be introduced to key theories and models in health psychology (e.g., the bi-opsychosocial model, social cognitive theory, theory of planned behaviour, health belief model).

PeopleImages/iStockphoto

What Is Health Psychology?

When most people think of a practising psychologist, they most often think of a psychologist who works with individuals suffering from mental health problems, such as depression and anxiety. Although this is frequently the case, the number of psychologists who work with people who are trying to adjust to and overcome medical conditions has shown explosive growth over the last 40 years. It is now commonplace for psychologists to work with people who are trying to manage conditions such as chronic pain, cancer, or obesity. Psychologists who specialize in working with people who have physical health problems are known as health psychologists. A survey of practising psychologists conducted by the American Psychological Association (2016) showed that clinical health psychology was the fourth most common of 15 specialties of practising psychology, with 19 per cent of psychologists indicating that they considered health psychology to be either their primary or secondary practice specialty.

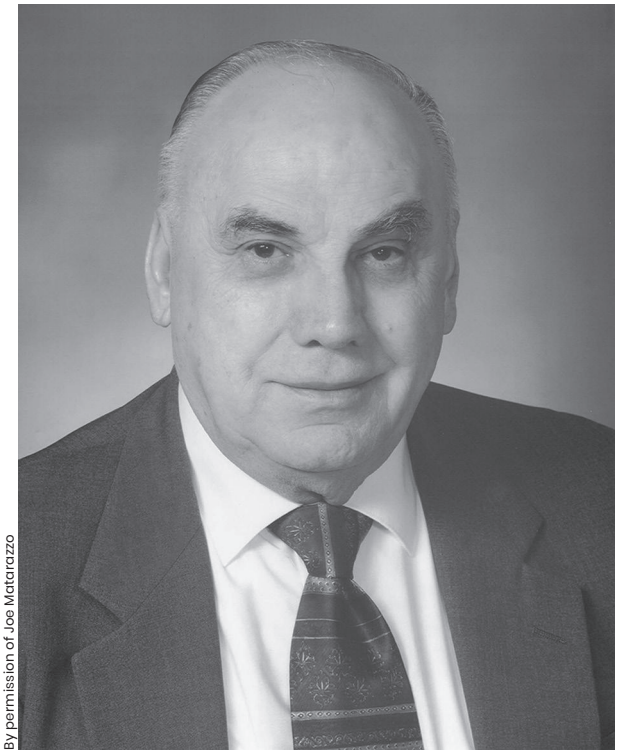
Health psychology can be thought of as a subspecialty of psychology, but also as a discipline-specific descriptor within the broad interdisciplinary field of **behavioural medicine**. The 1977 Yale Conference on Behavioural Medicine was organized to support the early stages of behavioural medicine, which at that time was a young, growing interdisciplinary field (Belar, Mendonca McIntyre, & Matarazzo, 2003). The conference led to the following definition of "behavioural medicine":

> "Behavioral medicine" is the field concerned with the development of behavioral-science knowledge and techniques relevant to the understanding of physical health and illness and the application of this knowledge and these techniques to diagnosis, prevention, treatment and rehabilitation. Psychosis, neurosis and substance abuse are included only insofar as they contribute to physical disorders as an end point (Schwartz &Weiss, 1977).

Three years after the Yale conference, a formal definition of health psychology was developed by American psychologist J.D. Matarazzo (1980, 1982; Gatchel, Baum, & Krantz, 1989), who was the first president of the Health Psychology Division (Division 38) of the American Psychological Association (APA). This definition remains widely accepted to this day:

> Health psychology is the aggregate of the specific educational, professional and scientific contributions to the discipline of psychology to the promotion and maintenance of health, the prevention and treatment of illness, and the identification of etiologic and diagnostic correlates of health, illness and related dysfunction.

Over the years, several applied subspecialties of health psychology have developed. **Clinical health psychology** is one of the most influential (American Psychological Association, 2011). Clinical health psychologists help people diagnosed with health conditions manage the symptoms of their health condition and address the psychological consequences of these symptoms. **Occupational health psychology** is another subspecialty that focuses on the prevention and management of occupational stress, the prevention of injury, and the maintenance of health of workers (Centers for Disease Control and Prevention, 2012). Another subspecialty, **community health psychology**, concerns itself with community-wide health needs and health-care systems. More specifically, community health psychologists aim to effect change and to promote access and cultural competence within health-care systems so that these systems can more effectively serve diversity within communities (De La Cancela, Lau Chin, & Jenkins, 1998).



By permission of Joe Matarazzo

Joseph D. Matarazzo developed the formal definition of health psychology.

Psychologists have made tremendous contributions to the prevention of illness, the maintenance of good health, and the management of a variety of conditions including but not limited to asthma (e.g., Grover, Kumaraiah, Prasadrao, & D'souza, 2002), diabetes (e.g., Fisher, Thorpe, Devellis, & Devellis, 2007), cardiovascular disease (e.g., Smith & Ruiz, 2002), and chronic pain (e.g., Ehde, Dillworth, & Turner, 2014). They have also helped thousands of people cope with the psychological consequences of serious illnesses such as cancer (e.g., McGregor et al., 2002) and AIDS (Smith Fawzi et al., 2012). Moreover, psychological interventions for patients with chronic illnesses can result in substantial medical cost savings (e.g., Hunsley, 2003). For example, Arving, Brandberg, Feldman, Johansson, and Gimelius (2014) conducted a randomized controlled study in order to evaluate the cost utility of psychosocial support interventions' effectiveness (in addition to standard medical care) for breast cancer patients. Total healthcare costs (estimated in euros) were at least €5000 less for people who received a psychosocial support intervention as compared to people who received standard medical care. Moreover, quality-of-life scores were significantly higher in the psychosocial intervention group compared to the standard care group. The researchers argued that unmet psychosocial needs result in increased utilization of health-care resources. Analogous results were obtained in a Canadian study involving cancer patients (Simpson, Carlson, & Trew, 2001). Specifically, women who completed medical treatment for breast cancer were randomly assigned to receive either standard psychosocial care available to patients or a structured group therapy intervention. The results showed that patients in the structured group intervention fared better with respect to adjustment and quality of life and that there were significant per patient cost savings even after accounting for the cost of the psychological intervention.

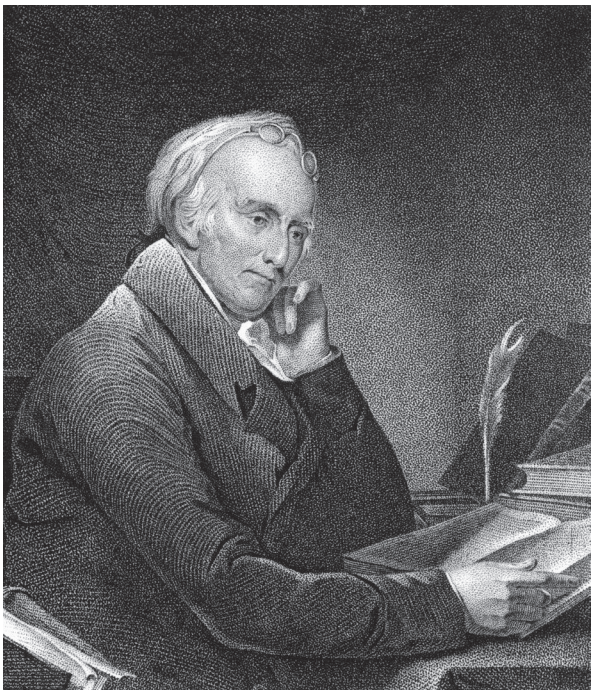
A Brief History of Health Psychology

The roots of health psychology can be traced back to early thinkers such as Hippocrates (460–377 BCE), who is considered by many to be the father of modern medicine, and Galen (129–99 CE). These early Greek physicians held a holistic view of health and considered the mind and the body to be part of the same system (Belar et al., 2003). They also believed that a balance between physical and emotional states was necessary to sustain overall health (Belar et al., 2003). Over the years, the popularity of these ideas varied. During the Renaissance, Descartes (1596–1650) argued in favour of what is now referred to as **Cartesian dualism** or the idea that mind and body are separate entities and that explanations for illness can be found in the body alone. This idea formed the basis for much of physical medicine in Western societies (Belar et al., 2003). Following Descartes, the role of psychological factors in illness was revived again in the nineteenth century. This eventually gave rise to the development of psychosomatic medicine, with the word "psychosomatic"

having been coined by Johann Christian August Heinroth (1773–1843), a German psychiatrist (Belar et al., 2003; Lipsitt, 1999). Psychosomatic medicine initially focused on illness behaviour that could be attributed to psychological causes. Consistent with this, Benjamin Rush (1746–1813) argued that "actions of the mind could cause many illnesses." Rush is considered to be the father of modern psychiatry for publishing the book *Medical Inquiries and Observations upon the Diseases of the Mind* (1812) and is credited with founding the American Medico-Psychological Association, which later became the American Psychiatric Association (Belar et al., 2003).

Development of the ideas that led to the emergence of health psychology are also linked to more recent thinkers, including Freud and other psychoanalysts who believed that certain symptoms such as paralysis and blindness represented manifestations of unconscious conflicts. In the 1940s, Franz Alexander helped establish psychosomatic medicine, which focused on the idea that physical disease can be the result of "fundamental, nuclear, or psychological conflict." Although these views did not adequately capture the multifactorial causation of disease (Straub, 2007), they led to explorations that contributed to today's accumulated knowledge of health. These explorations concerning the multifactorial causation of disease have been more directly stimulated by the behavioural sciences (Schwartz & Weiss, 1977).

In contrast to behavioural medicine, which has been more directly concerned with behavioural approaches (e.g., biofeedback, health-promoting behaviours) to the treatment and prevention of physical disease (Schwartz & Weiss, 1977), psychosomatic medicine has traditionally emphasized etiology and pathogenesis of physical disease. Gradually, psychosomatic medicine developed as a field through the work of clinicians such as Helen Flanders Dunbar, who became the founding editor of the *Journal of Psychosomatic Medicine*, which published its first issue in 1939 (Belar et al., 2003). The American Psychosomatic Society was founded in 1942 by an interdisciplinary group that included psychiatrists, psychoanalysts, psychologists, physiologists, and internists, with neurologist Tracy Putnam as its first president (Belar et al., 2003). Over time, psychodynamic theory and psychoanalysis gradually became less popular in North America because of criticisms about insufficient scientific rigour. Nonetheless, a variety of scholars and clinicians continued to explore the interdependence of psychological factors, such as stress and disease. Guze, Matarazzo, and Saslow (1953) published an account of the **biopsychosocial model** as a foundation of comprehensive medicine, although later work by George Engel (1977) on the biopsychosocial model became more widely cited (Belar et al., 2003).



Classic Image / Alamy Stock Photo

Benjamin Rush (1746–1813).

In terms of the organized discipline of psychology, in 1973 the American Psychological Association appointed a task force to explore psychology's role within behavioural medicine and in 1978 created a health psychology division (Division 38) (Straub, 2007). The Health Psychology Division of APA is one of the five largest divisions within the organization (France, 2011). The Health Psychology Section (which has since been renamed as the Health Psychology and Behavioural Medicine Section) of the Canadian Psychological Association (CPA) was founded in the early 1980s (John Conway, personal communication, 10 November 2011). According to a 2017 count, the Health Psychology

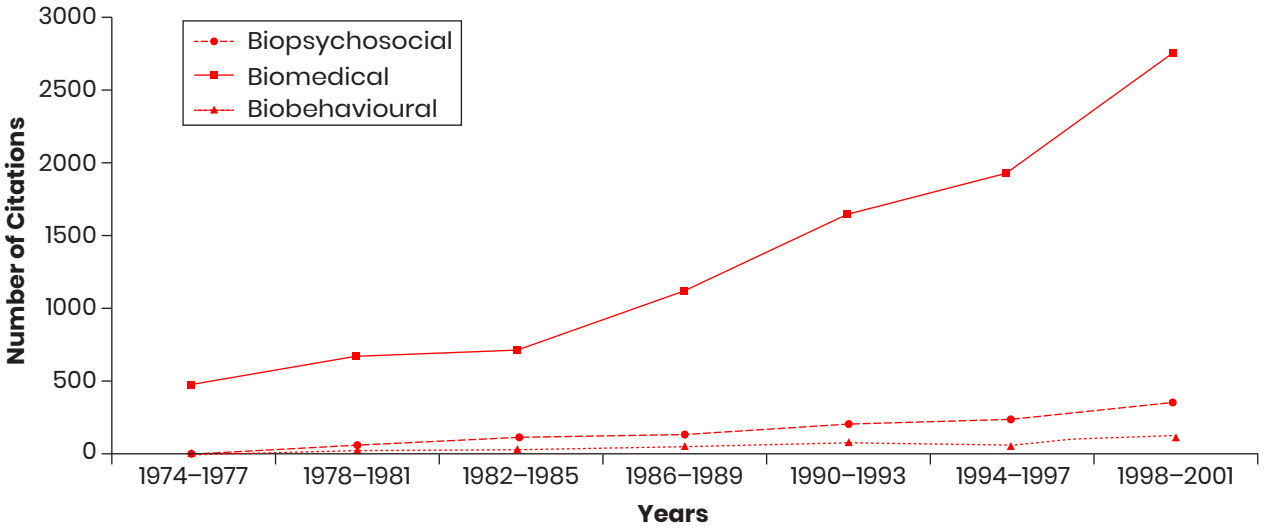
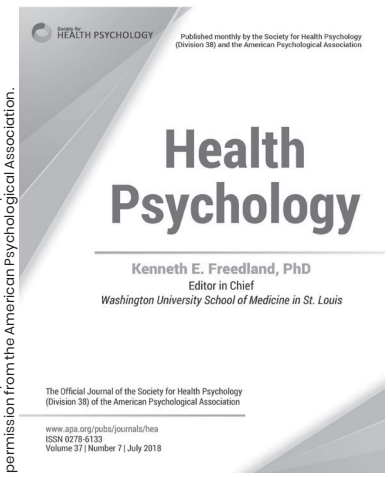


FIGURE 1.1 Frequency of citations of "biopsychosocial," "biobehavioral," and "biomedical" in Medline.

Source: Suls, J., & Rothman, A. (2004), Evolution of the biopsychosocial model: Prospects and challenges for health psychology. *Health Psychology*, 23(2), 119–125..

and Behavioural Medicine Section of the CPA was the eighth-largest section (out of a total of 32 sections). Developments similar to those pertaining to the formation of formal health psychology groups in North America also took place in Europe and Asia, with a variety of special-interest groups and organizations developing over the 1980s and 1990s (Belar et al., 2003). Health psychology is also recognized as a specialty by the American Board of Professional Psychology, the oldest credentialling group in psychology (Belar, 1997).

The growth of the field is demonstrated not only by an explosion in the number of articles in the field of health psychology but also by dramatic growth in government research support for health-related behavioural and psychological research, especially in the United States (Suls & Rothman, 2004). As an example of the growth, during the years 1974–7 the term "biopsychosocial" was mentioned in six articles, but in the 1999–2001 period it appeared in 350 articles (Suls & Rothman, 2004). Another way of illustrating the rapid growth of the field is to point out that the word "biomedical" increased in frequency by a factor of 5 during the same period whereas the word "biopsychosocial" increased by a factor of 60 (Suls & Rothman, 2004) (see Figure 1.1).



The journal *Health Psychology* is published by the American Psychological Association and its mission is "to advance the science and practice of evidence-based health psychology and behavioral medicine."

Careers in Health Psychology

Health psychologists are often trained to conduct both applied (e.g., clinical) work and research. However, health psychologists interested in academic or related research careers are sometimes trained exclusively as researchers. Generally speaking, health psychologists in North America tend to seek doctoral or post-doctoral training, although some acquire terminal master's degrees. A program leading to a doctoral degree typically requires five to seven years of graduate study. Clinical health psychologists are often trained within clinical psychology doctoral programs with faculty members qualified and

interested in health psychology. This allows these graduate students to conduct health psychological research, take courses relevant to health psychology, and complete internships and practica with a focus on health psychology. Post-doctoral training opportunities are also available. The following In Focus box lists the core competencies, according to the Health Psychology Division of the APA, that health psychologists should have.

Many CPA-accredited graduate programs in clinical psychology have faculty members with strong interests and expertise in health psychology.* For example, within the

Courtesy of Thomas Hadjistavropoulos

Using safe and sophisticated equipment, the health psychology laboratory at the University of Regina has studied social and psychological influences on pain as well the effects of anxiety on balance. The lab is equipped with sophisticated equipment including a computerized sensor mat (the GaitRite® System) that has been used in the evaluation of gait and balance in older adults while psychophysiological indicators of anxiety (heart rate and skin conductance) are being recorded using wireless psychophysiological monitoring equipment. Pictured here is the TSA-II neurosensory analyzer (made by Medoc Medical Systems), which is controlled by a computer and is used to document responses to stimuli that vary in intensity (e.g., heat, cold, etc). The TSA-II can be used in laboratory studies of pain reactions (e.g., in response to pain induced by exposure to heat). A release button, controlled by the volunteer participant, can instantly terminate the stimulation if the participant finds it to be too discomforting.

* The material and examples concerning training and research opportunities in health psychology are based on information gathered at the time of writing of this chapter. Some of the information concerning program offerings and research interests in various universities may have changed since then. Interested students are encouraged to examine university websites and contact departments of psychology directly for more up-to-date information.

In Focus

Competencies in Research for Health Psychologists

The following lists describe the suggested competencies that are taught in many programs in health psychology without reference to clinical training. Of course, not all health psychology programs require all of the same competencies from all of their graduates. It is the unique feature of research-oriented Ph.D. programs to provide sufficient flexibility to allow the developing scientist to acquire a unique set of skills. Similarly, different health psychology programs have different research emphases ranging from epidemiological studies, to exploring mechanisms of disease, to developing individual or population-based interventions. Nevertheless, it is appropriate at this time for our academic colleagues to ask about the competencies that help to define health psychology researchers and for health psychology programs to emphasize such competencies in their curriculum. The list of competencies described is intended to cover in a general way the broad field of health psychology research as it exists today. Central to the work described below is the concept of health behaviour, which refers to all actions or behaviours related to health and well-being. Health behaviours can range from adaptive (e.g., exercising, taking medications as prescribed, and getting regular check-ups) to maladaptive (e.g., overeating, under-eating, drinking, smoking, and engaging in high levels of sedentary behaviour).

Knowledge base: The entry-level health psychologist researcher should have knowledge of:

The historical relationship of health psychology to the basic sciences, public health, and clinical investigation.

Scientific foundations and methods of psychology and exposure to allied health disciplines (e.g., epidemiology, physiology, genomics, bioinformatics).

Biobehavioural, social-environmental, and psychological factors associated with health behaviours, illness, and disease.

Mechanistic and mediational pathways between contextual, psychosocial, and biological phenomena as they relate to disease progression, health promotion, and illness prevention.

Biological, psychological, behavioural, and sociocultural tools (e.g., psychophysiological assessment, interview techniques, assessment development, observational coding, focus groups, web-based informatics tools) relevant to individuals and systems.

Dynamic interactions between populations and contextual variations (age, gender, ethnicity, culture, religion, etc.) on health behaviour and health outcomes.

Pathophysiology of disease and the implications for development of biopsychosocial treatments.

Appropriate methods and procedures to develop a program of research.

Strengths and potential pitfalls of role relationships that characterize interdisciplinary collaborative research.

Regulatory and ethics competence in relation to interdisciplinary research.

University of Regina Clinical Psychology graduate program, there are strong interests in the areas of pain and health anxiety. A wide range of health psychology interests are represented in Canadian psychology departments (e.g., McGill University, Université de Montréal, Ryerson University, and many others). Research interests in health psychology can be found in numerous departments in the United States (e.g., University of Florida, George Washington University). Training in experimental health psychology with a primarily research focus is

Applications: The entry-level health psychologist should be able to:

- Evaluate biopsychosocial findings related to physical health or physical illness, injury, or disability.
- Assess biopsychosocial and behavioural risk factors for the development of physical illness, injury, or disability.
- Assist in assessment of new and emerging health technologies.
- Develop health psychology research protocols and evaluate their effectiveness and quality.
- Evaluate biopsychosocial and cognitive assessment tools appropriate to understanding physical illness, injury, or disability.
- Design and evaluate empirically supported health promotion, prevention, and other interventions appropriate to target populations in the context of an interdisciplinary team.
- Apply diverse methodologies to address contextual, psychosocial, and biological processes as they relate to disease progression, health promotion, and illness prevention.
- Select, apply, and interpret data-analytic strategies that are best suited to the diverse research questions and levels of analysis characteristic of health psychology.
- Work towards translation of research findings to applied settings.
- Translate issues presented by professionals from other disciplines into research questions and appropriate methods for investigation.
- Integrate the talents and skills of professionals from different disciplines and different levels of training (e.g., master's, doctoral) to optimize research.
- Integrate within and lead in the formulation of interdisciplinary research teams.
- Accurately and efficiently communicate research findings in a manner that is consistent with the highest standards within the profession in ways that can be understood by fellow psychologists, professionals from other disciplines, and lay audiences alike.
- Write a research proposal of a quality sufficient to be submitted to a granting agency.
- Publish in peer-reviewed journals in the area of health psychology.
- Understand the bounds/limits of one's research competence.
- Obtain proficiency in a traditional area of psychology such as psychophysiology, psychometrics, statistics, affect and cognition, or social psychology.
- Obtain knowledge, exposure, and competency outside of an area of traditional psychology (e.g., epidemiology, genetics, neural imaging, body imaging, assaying biomarkers, nutrition, exercise, sleep).
- Demonstrate adequate training and evidence of skill as a teacher, and have the requisite knowledge to develop and implement an undergraduate health psychology course.
- Understand the role and responsibilities of an effective mentor, and have the ability to promote the development of research and teaching competencies in graduate and undergraduate students.

Source: American Psychological Association Division 38 (2014).

also offered at some universities (e.g., the University of British Columbia and the University of Pittsburgh).

At the time of this writing, specialized occupational health psychology training was offered by several universities, including but not limited to the University of Nottingham (UK), Leiden University (The Netherlands), and several US schools such as the University of Connecticut, Central Michigan University, Portland State University.

Health psychologists are employed by general and specialized (e.g., cancer, physical rehabilitation) hospitals and private clinics treating patients with complex problems (e.g., chronic pain), as well as in private practice. As private practitioners, health psychologists often serve as consultants to the legal and insurance systems and provide expert opinion about a variety of case scenarios (e.g., psychological consequences of accidents, extent of disability). They also provide psychological treatment services to patients diagnosed with various health conditions. Many practising health psychologists often combine their professional work with some university teaching (e.g., teaching an evening course or supervising practica and internships of graduate students in psychology). Health psychologists often are employed as instructors and researchers in psychology, psychiatry, and a wide variety of other university (e.g., health studies, gerontology, anaesthesiology, general medicine) and teaching hospital departments. Funding sources for health psychology research include such agencies and organizations as the National Institutes of Health (US), the Canadian Institutes of Health Research, and the Heart and Stroke Foundation.

TABLE 1.1 | Activities of Clinical Health Psychologists

Types of Conditions: Chronic Pain, Cancer, Cardiovascular Disease, Diabetes, HIV, Multiple Sclerosis, Obstetrics and Gynecology, Asthma, Chronic Obstructive Pulmonary Disease, Gastrointestinal Conditions, Renal and Urological Conditions

Example Assessment Questions:

1. How is the individual emotionally adjusting to the health condition?
2. What impact is the health condition having on the client's quality of life and functioning?
3. Are pre-existing mental health conditions or psychological variables impacting the individual's ability to cope with the health condition?
4. To what extent is the individual adhering to medical treatment and does the he or she require assistance with this treatment?
5. How is the medical condition impacting the social environment and how is the social environment impacting the individual's health condition?
6. To what extent is the person engaged in maladaptive lifestyle behaviours (e.g., substance use, smoking, over-eating, under-eating) that are impacting his or her health condition and does he or she require support in changing maladaptive lifestyle behaviours?

Example Goals of Therapy:

1. To assist the client in identifying, understanding, and managing emotional responses to health (e.g., depression, anxiety, health anxiety, pain-related anxiety), including pre-existing mental health conditions that may be impacting health.
2. To assist the client in identifying and challenging negative thoughts that could be interfering with managing health conditions (e.g., beliefs about inability to cope, lack of support, lack of control).
3. To help the client identify, understand, and explore various strategies for coping with health conditions (e.g., relaxation, problem solving, mindfulness, pacing).
4. To identify and problem solve on strategies for improving adherence to medical recommendations.
5. To identify and effectively engage with persons who provide social support to clients with health conditions.
6. To identify, discuss, and cope with concerns about relationships with health-care providers.
7. To identify and manage maladaptive lifestyle behaviours impacting health (e.g., weight, smoking, substance use).

At the time of this writing, valuable information about careers and training in health psychology was available on the website of the health psychology division of APA (www.health-psych.org). Additional information about health psychology was available on the website of the health psychology and behavioural medicine section of CPA (www.cpa.ca/aboutcpa/cpasections/healthpsychology).

Major Theories and Models in Health Psychology

Throughout this text we present a variety of theories and models that have been used and validated within the context of health psychology and behavioural medicine. These theories and models include, but are not limited to, the biopsychosocial model of health (Chapters 9 and 15), the gate control theory of pain (Chapter 9), cognitive behavioural theory (Chapters 7, 9, and elsewhere), and the stages of change model (i.e., transtheoretical model, Chapter 5). The broad strokes of some of these perspectives are presented in this chapter. The biopsychosocial model is discussed because of its breadth and impact on the entire discipline, while other formulations (e.g., the health belief model, social cognitive theory) are presented as specific introductory examples of the wide range of theoretical foundations that influence the work of health psychologists.

The Biopsychosocial Model

Health psychology operates within the biopsychosocial model of health that considers the interplay and integration of biological, psychological, and social factors on health (see Figure 1.2). The biopsychosocial model forms the conceptual basis of health psychology (Suls & Rothman, 2004). This approach contrasts with the traditional medical model of disease that separates the physical and psychosocial. An assumption of the medical model of disease is that illness is entirely physical and questions about illness are answerable objectively and deterministically (Child, 2000). However, such conceptualizations fail to fit the data because the role of psychological, social, and behavioural factors in the causation and maintenance of disease are well established (Rozanski, Blumenthal, & Kaplan, 1999; Schneiderman, Antoni, Saab, & Ironson, 2001). For example, social support has been shown to have a positive effect on health-related self-care behaviours of cardiac patients (Salyer, Schubert, & Chiaranai, 2012), and inadequate social support and reduced use of problem-solving coping strategies by patients are associated with increased pain and lower functional outcomes in post-surgical samples (Lopez-Olivo et al., 2011). It is also well documented that psychological stress can have negative consequences for human immune responses (Segerstrom & Miller, 2004).

Many health problems can be conceptualized through the biopsychosocial model (e.g., obesity, drug addiction).

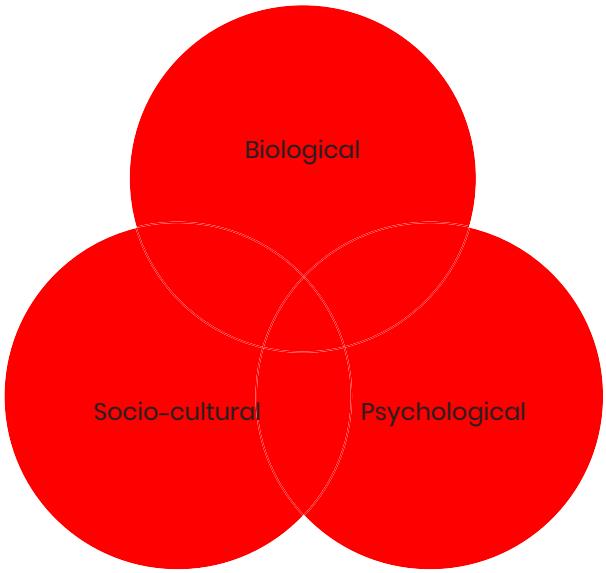


FIGURE 1.2 The biopsychosocial model of health recognizes the importance of biological, psychological, and socio-cultural influences.

Source: Figure I Biopsychocultural Framework July 10, 2010 © A.E. Núñez available at http://culturegenderhealth.blogspot.com/2010/07/which-is-correct-term-sex-gender-both.html

In Practice

Dr Christine Chambers is a pediatric health psychologist at the IWK Health Centre and a professor of pediatrics and psychology at Dalhousie University. Clinically, she has expertise in providing behavioural and cognitive behavioural interventions for children with acute and chronic medical illnesses and their families, with a focus on management of chronic pain and preparation for painful medical procedures. Her research examines the role of a variety of developmental, psychological, and social factors that influence children's pain, with a focus on family factors in pediatric pain and pain measurement in children.

8:30 a.m. to 10:00 a.m.: Undergraduate health psychology class

Dr Chambers delivers a lecture at the university on the topic of managing chronic illnesses to a classroom of undergraduate students, most of whom are interested in various careers as health professionals, such as medicine, nursing, physiotherapy, and psychology. The students have a few last-minute questions, before the paper is due next week, about their personal health projects, for which they have chosen a health-related behaviour to modify and measure, and then assess the effectiveness of their intervention.

10:00 a.m. to 11:00 a.m.: In the office

Dr Chambers heads over to the IWK Health Centre to her office and research lab in the Centre for Pediatric Pain Research, where she catches up on the latest issue of the *Journal of Pediatric Psychology* and gives feedback to a graduate student on the results section of the student's dissertation on the role of children's memories for pain. She also speaks briefly with a reporter from *Today's Parent* magazine who has contacted her for input on an article about how parents can help their children better cope with immunization pain.

11:00 a.m. to 12:00 p.m.: Teleconference

Just before lunch, Dr Chambers has a teleconference with colleagues on the development of a multi-site Internet-based intervention to address children's sleep problems. This work is a team grant funded by the Canadian Institutes of Health Research and is led by a colleague of Dr Chambers at the university, but includes team members at various other universities and children's hospitals across Canada.

Christine Chambers

Dalhousie University health psychologist Christine Chambers.

12:00 p.m. to 1:00 p.m.: Lunch and clinical rounds

Dr Chambers enjoys her lunch during an interesting clinical rounds presentation by a colleague on the Pediatric Health Psychology Service. The colleague describes a challenging case of an adolescent with celiac disease who has had difficulties adhering to a gluten-free diet—if the youth cannot maintain the diet, this could have a significant negative impact on long-term health. The psychologists on the service, including Dr Chambers, offer various ideas and suggestions.

1:00 p.m. to 2:30 p.m.: Lab meeting

After lunch Dr Chambers attends her weekly lab meeting with her research team. An undergraduate honours student working with Dr Chambers presents preliminary results from a study examining the relationship between general parenting style and how

parents report responding to the pain children experience during daily minor injuries.

2:30 p.m. to 3:30 p.m.: In the clinic

Dr Chambers follows up with one of her patients, a 10-year-old boy, who was referred for treatment of a severe needle phobia. It is their second session together and today they are gradually working their way through various exposure exercises related to the fear hierarchy they generated in the first session. For example, today Dr Chambers has brought pictures of children getting needles and a toy needle for the child to view and manipulate.

3:30 p.m. to 5:00 p.m.: Treatment group for children with recurrent abdominal pain

Dr Chambers provides supervision for a group of practicum students who are leading a six-week cognitive behavioural therapy group for children with recurrent abdominal pain and their parents. The group focuses on teaching children coping strategies to deal with their pain by targeting the thoughts, feelings, and behaviours associated with their pain and symptoms by employing evidence-based strategies, like deep belly breathing, guided imagery, and positive self-talk. In this session, the children practise progressive muscle relaxation while the parents learn about the importance of their own responses to their child's pain.

5:00 p.m. to 10:00 p.m.: Evening at home

Dr Chambers heads home and enjoys some play time with her young children before preparing dinner and helping her husband put the children to bed. She replies to a few e-mails from her students and colleagues and does some last-minute editing on the final draft of the chapter she has been writing on families and pain before heading to bed to get a good night's sleep.

In the case of obesity, for instance, biological factors (e.g., some people may inherit a tendency to gain more weight or a slower metabolic rate), psychological factors (e.g., depression and low self-esteem may lead a person to eat more calorie-dense foods such as in desserts and/or to become physically inactive), and social factors (e.g., socio-economic factors such as in ability to afford healthier foods that may be more expensive than "junk food"; absence of social support) can contribute to the problem as well as play an important role in one's ability to lose weight and maintain the weight loss.

The biopsychosocial model is detailed elsewhere in this volume. Chapter 9, for example, presents a detailed illustration of the model in relation to pain; Chapter 15 discusses the important role of culture in biopsychosocial conceptualizations of health and illness. The breadth of the biopsychosocial perspective has encouraged the development of other theories and models that provide more detailed descriptions and hypotheses related to specific components of the biopsychosocial model (e.g., the specific role of beliefs and cognitions and the role of reinforcement in health and illness). Some of these key models and theories (e.g., the health belief model, social cognitive theory, and the theory of planned behaviour) are introduced below because of their breadth and applicability to a variety of health-related issues.

Health Belief Model

The **health belief model** (Janz & Becker, 1984; Rosenstock, 1974) has been very influential in health psychology (Glanz & Bishop, 2010). The model postulates that readiness to take action in relation to health problems is a function of people's beliefs (e.g., perceived severity of one's health condition, perceived risk of getting the condition, perceived barriers to adopting a health-promoting behaviour) and of their perception of the benefits of taking action to prevent health problems (Champion & Skinner, 2008; Rosenstock, 1974). The model, therefore, facilitates an understanding of possible reasons for non-compliance with health-care recommendations (Turner, Hunt,

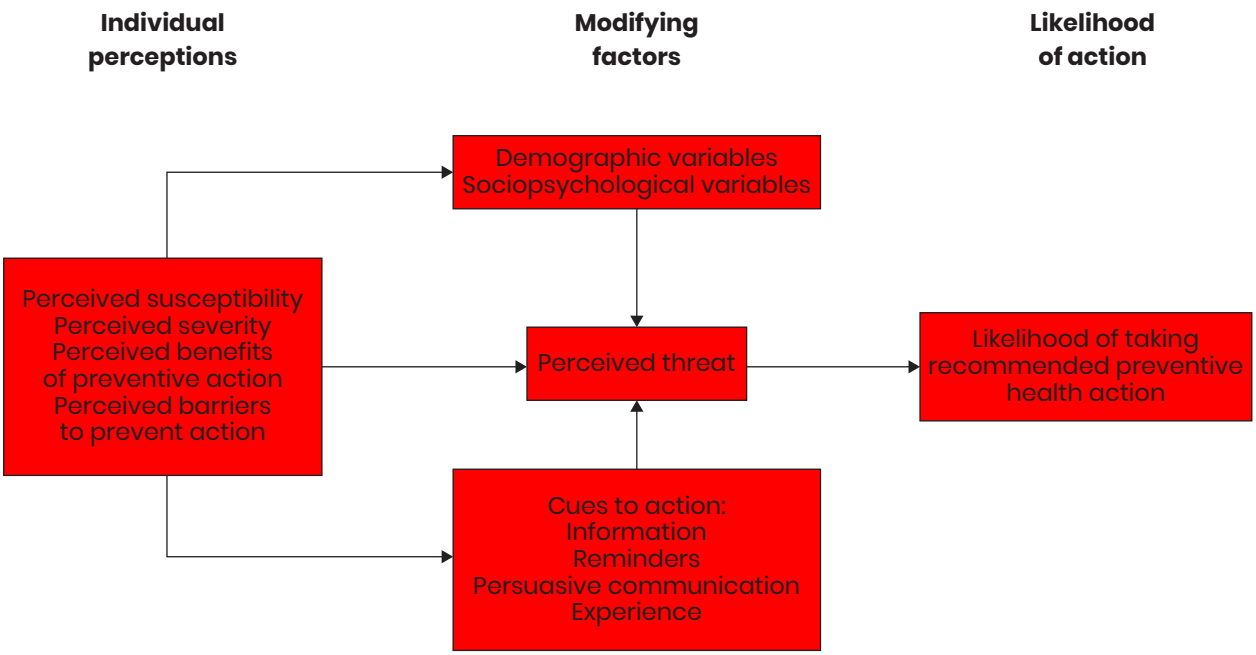


FIGURE 1.3 **The health belief model.**

Source: Simons-Morton, *Introduction to Health Education and Health Promotion*, 2e, Waveland Press

Dibrezzo, & Jones, 2009). Factors that may affect these types of beliefs (e.g., demographic variables) are also considered in the model (see Figure 1.3). Empirical support for the model is available in that attitudes and beliefs have been shown repeatedly to affect health-related behaviour (Janz & Becker, 1984). For example, beliefs regarding susceptibility to disease (i.e., the flu) and beliefs regarding disease severity and potential benefits of influenza vaccines predict whether individuals will obtain an influenza vaccine (Larson, Olsen, Cole, & Shortell, 1979). On the other hand, the model does not fully explain the full range of reasons (e.g., economic factors) that affect decisions to engage in health behaviours (Janz & Becker, 1984) (see also Chapter 15).

Social Cognitive Theory

Social cognitive theory is based on the work of Albert Bandura (1986, 1991a, 1991b) and considers human behaviour as being reflected in a three-way model in which personal factors, environmental influences, and behaviour commonly interact (McAlister, Perry, & Parcel, 2008). Reinforcement, observational learning, self-control, and self-efficacy (i.e., people's beliefs about their ability to effectively address a situation and to yield desirable results) are central constructs in this theory. According to Bandura, self-efficacy develops through social experiences, observing others, and personal experiences, including any internal experiences that provide the person with information about his or her personal strengths and weaknesses. For example, self-efficacy to manage pain may be influenced by our observations of how family members have coped with pain as well as by our personal experiences of coping with pain. Social cognitive theory helps explain the socio-cultural and personal determinants of health (Bandura, 1998) and is largely consistent with the biopsychosocial model of health, with the greatest emphasis, however, placed on describing social variables involved in health.

Many aspects of the theory have been well supported. For example, self-efficacy beliefs concerning one's ability to control one's health play an important role in our understanding of health-related functioning, including recovery from coronary artery surgery (Allen, Becker, & Swank, 1990; Bastone & Kerns, 1995), coping with cancer (Beckham, Burker, Lytle, Feldman, & Costakis, 1997), renal disease (Devins et al., 1982), adherence to medication (Brus, van de Laar, Taal, Rasker, & Wiegman, 1999; De Geest et al., 1995), decreasing risk of osteoporosis through calcium intake and physical activity (Haran, Kim, Gendler, Froman, & Patel, 1998), and other conditions. This influence occurs largely as a result of the behaviours (e.g., health-promoting behaviours) that self-efficacy beliefs influence and regulate. Specifically, beliefs about self-efficacy influence our health behaviours, which then affect health outcomes. Similarly, social support helps alleviate depression and physical dysfunction, and leads to health-promoting behaviours largely because it raises perceived coping self-efficacy (Bandura, 1998; Cutrona & Troutman, 1986; Duncan & McAuley, 1993; Major, Mueller, & Hildebrandt, 1985). Moreover, effective coping with stressors has been shown to improve immune function (Antoni et al., 1990; Gruber, Hall, Hersh, & Dubois, 1988; Kiecolt-Glaser et al., 1986).

https://profiles.stanford.edu/albert-bandura

Originally from Alberta, Canada, Stanford University psychologist Albert Bandura has served as honorary president of the Canadian Psychological Association.

Theory of Planned Behaviour

The **theory of planned behaviour** (e.g., Ajzen, 1991) is an expansion of a pre-existing formulation known as the theory of reasoned action (e.g., Ajzen & Fishbein, 1980). According to Ajzen (1991; n.d.), our behaviour is determined by three types of beliefs: (1) *behavioural beliefs* (i.e., beliefs about the likely consequences of behaviour), (2) *normative beliefs* (i.e., beliefs about others' expectations), and (3) *control beliefs* (i.e., beliefs about factors that facilitate or prevent performance of behaviour). As an example, whether we exercise or not may be influenced by our beliefs about whether exercise is beneficial (behavioural belief), beliefs about whether others expect us to be physically active (e.g., normative beliefs), or beliefs about how much control we have over our actions, such as whether we can afford to purchase exercise gear (e.g., control beliefs). As Figure 1.4 illustrates, behavioural beliefs lead to favourable or unfavourable *attitudes* about the behaviour; normative beliefs lead to perceived social pressure related to the *subjective norm*; and control beliefs lead to a *perception of behavioural control*. In turn, the attitudes, subjective norms, and perceived behavioural control affect the strength of the *intention* to perform the behaviour and, ultimately, the actual performance (or lack thereof) of the behaviour. The theory also gives consideration to the extent to which the individual has *actual* (as opposed to just *perceived*) *control* over the behaviour, as shown in the figure.

A considerable body of research has supported the use of the theory of planned behaviour in the prediction of intention and behaviour, although the prediction of self-reported behaviour appears to be stronger than the prediction of actual behaviour (Armitage & Conner, 2001). Similarly, evidence has shown a distinction between desire and intention, as well as between self-efficacy and

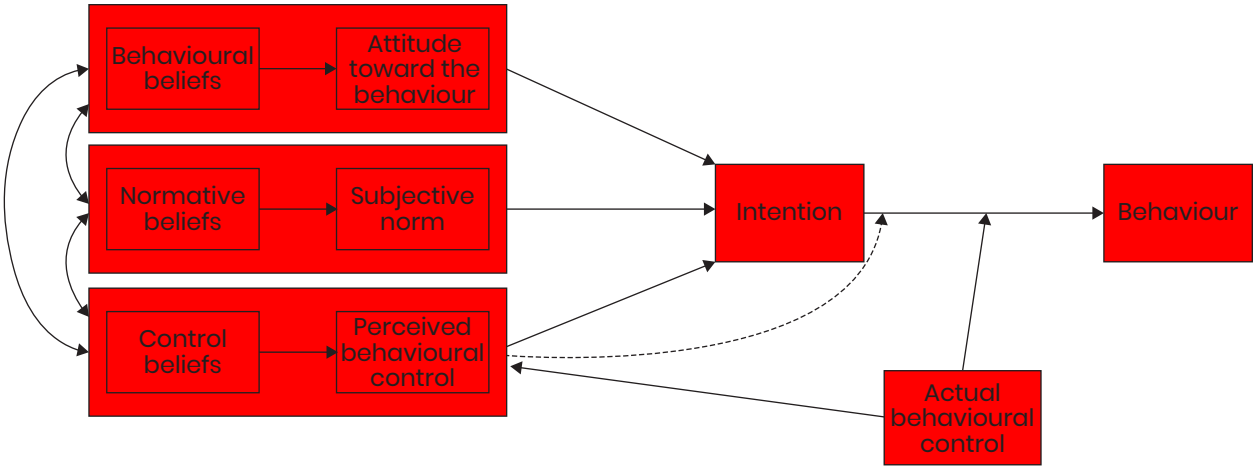


FIGURE 1.4 **Theory of planned behaviour.**

Source: Icek Ajzen, Professor Emeritus, University of Massachusetts.

perceived control over behaviour (Armitage & Conner, 2001). Nonetheless, the theory has been criticized for neglecting the important role of emotion, as well as cultural factors, in the determination of behaviour (e.g., Munro, Lewin, Swart, & Volmink, 2007). Within health psychology, the theory of planned behaviour has been used to study a wide range of health-related behaviours, such as adherence to diet and physical activity, in diverse clinical populations (e.g., Vallance, Lavalee, Culos-Reed, & Trudeau, 2012; Welsh et al., 2013). This theory is discussed further in Chapter 11.

The Common-Sense Model of Self-Regulation/Illness Representation

The **common-sense model (CSM) of self-regulation** (Leventhal, Phillips, & Burns, 2016; also referred to as the **CSM of illness representations**; Leventhal, Meyer, & Nerenz, 1980) is a theoretical framework within health psychology that describes the way people process and cope with health threats. The model specifically suggests that individuals form a lay view of their health based on various sources of information and this lay view guides their coping responses (e.g., whether they seek help or follow advice on how to manage illness). For example, people form beliefs about the identity, cause, consequences, timeline (acute/chronic and cyclical), controllability (personal and treatment control), and emotional impact of physical sensations that they experience. These beliefs, related to the physical sensations, are influenced by past experiences with their health, cognitive heuristics (i.e., rules that people use to make decisions and judgements), social factors, culture, personality, and mood. The model suggests that there is continuous feedback between the efficacy of how people cope with health threats and their perceptions of the health threat. The model has been used to develop interventions to assist people in coping with illness. For example, targeting perceptions of cure/control of illness assists with improving medical adherence (Jones et al., 2016). This model is discussed in more detail in Chapter 7.

Cognitive Behavioural Perspective

The cognitive behavioural perspective is often employed within the field of health psychology. Most commonly this perspective is used to assist clinicians in understanding how individuals

respond to physical symptoms or medical conditions (White, 2001). The perspective was originally developed to understand depression, but has been extended to other mental health conditions as well as in explanations of the way in which people respond to health problems (Beck & Dozois, 2011).

In the case of medical conditions, our cognitive appraisals of internal sensations (e.g., physical symptoms) and external events (e.g., receiving a medical diagnosis) play an important role in how we act or respond (e.g., our reactions to our medical condition) as well as how we feel (e.g., depression, anxiety). The cognitive behavioural perspective also emphasizes that thoughts, behaviour, and emotions are interconnected and thus our behaviours and emotions also influence our thoughts. In other words, different people with the same health condition may show different emotional responses to their health depending on their thoughts (e.g., "this symptom is catastrophic" vs "I will be able to cope with this symptom") and behaviours (e.g., engaging in adaptive health-promoting vs self-destructive behaviours). A substantial body of research has provided empirical support for the cognitive behavioural perspective in general and specifically for the relationship between negative beliefs and adjustment (Beck & Haigh, 2014).

Cognitive behavioural therapy (CBT), based on the cognitive behavioural perspective, is often the treatment of choice for psychologists working with patients who are having difficulties managing health conditions (Jensen et al., 2013; Kerns et al., 2014; Stagl et al., 2015) The treatment is typically short-term, goal-oriented, and present-day focused, with the therapist helping the patient identify and challenge unhelpful thoughts and learn individual skills that will assist with or improve her or his health condition (White, 2001). In the chapters that follow, we illustrate applications of CBT with specific conditions.

The Transtheoretical Model of Behaviour Change

The transtheoretical model (detailed in Chapter 5) specifically focuses on five stages of change people may experience when modifying health behaviours (e.g., smoking, alcohol use) (Prochaska, Wright, & Velicer, 2008). The stages include precontemplation, contemplation, preparation, action, maintenance, and termination. For example, consider a person who would like to quit smoking. This person can be viewed as going through varying stages of quitting, ranging from fleeting thoughts of quitting without a specific plan (precontemplation), to intending to quit within the next six months (contemplation), to preparing to quit by picking a quit date in the immediate future and by taking other preparatory steps such as buying a self-help book (preparation), to taking action by using a nicotine patch and making other lifestyle changes (action), to working to prevent relapse by planning to have coping strategies for use in situations where the risk of smoking might be high (maintenance), and, finally, to having 100 per cent confidence that he or she will not smoke again (termination). Different thoughts and behaviours are associated with each stage. Along with stages of change, this model also discusses various processes of change (i.e., behavioural and experiential actions that people use to make changes) and the way in which decisions about change are made. There is some evidence to suggest that interventions that are matched to the individual's stage of change tend to be more effective (e.g., Noar, Benac, & Harris, 2007).

Future Directions

In a review of the state of the discipline of health psychology, Miller, Chen, and Cole (2009) concluded that although health psychology has shown considerable growth in documenting the relationship between psychological factors and disease, the most significant challenge that remains for

future research involves the need for a better understanding of the biological processes mediating this relationship. Miller and colleagues also identified a series of advanced methodologies that are becoming increasingly influential and have the potential to help resolve the puzzle of how psychological variables impact health. These methodologies include, but are not limited to, sophisticated statistical approaches for testing complex relationships among variables, use of non-invasive imaging systems (e.g., magnetic resonance imaging [MRI]), use of biomarkers such as C-reactive protein (CRP; an inflammatory biomarker that appears to increase in response to stress), and use of laboratory analyses that permit the capture of a wide range of basic scientific information, including patterns of gene activity. With respect to applied areas, future research is expected to emphasize questions about the cost-effectiveness of health psychology, how to translate knowledge in health psychology into practice, and how to improve delivery of health psychology services through the use of technology, such as the Internet and mobile apps. While there is a proliferation of health-related mobile apps (e.g., targeting behaviours related to weight loss, for example), more systematic research is needed to evaluate their efficacy and establish standards for best practices (Payne, Lister, West & Bernhardt, 2015). Health psychologists must also not lose sight of changing demographics, and ensure that interventions are appropriate for a population that is becoming increasingly ethnically diverse and older (Smith, Orleans, & Jenkins, 2004). Health psychology must also pay greater attention to non-industrialized parts of the world, where it is estimated that 90 per cent of the global burden of disease exists, but where only 10 per cent of the world's healthcare resources are found (Lyons & Chamberlain, 2006).

Summary

Health psychology is a subspecialty within the field of psychology, but also a discipline-specific descriptor within the interdisciplinary field of behavioural medicine. The field is concerned with education, research, and practice related to the promotion and maintenance of health and the prevention and treatment of illness. The discipline has grown tremendously since it was defined by Matarazzo (1980), and now has several subspecialties, including clinical health psychology, occupational health psychology, and community health psychology.

The roots of health psychology can be traced back to early Greek physicians who believed that the mind and body are part of the same system and intricately related. These holistic ideas of health re-emerged in the nineteenth century, after a predominant conceptualization in Western society of the mind and body as separate entities (Cartesian dualism) over the previous two centuries. This re-emergence began with the field of psychosomatic medicine, which acknowledged that psychological factors could explain physical symptoms. Gradually, scholars and clinicians began to explore the interdependence of psychological factors and physical health, and the field of behavioural medicine emerged, with an emphasis on behavioural approaches to treating physical disease.

The field has attracted many psychologists, and today health psychologists are often trained to conduct both applied (e.g., clinical) work and research. Health psychologists in North America tend to seek doctoral or post-doctoral training. In terms of employment settings, health psychologists are often employed in academic institutions or in clinical settings, such as general and specialized (e.g., cancer, physical rehabilitation) hospitals, private clinics treating patients with complex problems (e.g., chronic pain clinics), or private practice.

Health psychologists typically conceptualize health and illness using a biopsychosocial model of health that regards both health and illness as stemming from interactions among biological (e.g., genetic), psychological (beliefs, emotions, behaviours), and social (relational) variables. Other models/theories/perspectives that health psychologists commonly draw on in both research and clinical work

are the health belief model, social cognitive theory, the theory of planned behaviour, the common-sense model of self-regulation, the transtheoretical model of behaviour change, and the cognitive behavioural perspective. These models are consistent with the assumptions of the broader biopsychosocial conceptualization, but focus on identifying variables that predict health behaviour.

Critical Thought Questions

1. Have you considered a career in health psychology? If you were to consider such a career, would you be most interested in the applied or research aspects of the discipline? Which areas of focus within health psychology (represented in the various chapters of this book) would interest you the most and why?
2. To what extent do you believe that in 25 years professional psychologists will be engaged in clinical work with people who present primarily with physical conditions (e.g., chronic pain, cancer, cardiovascular disease) as opposed to working largely with people whose primary problems are related to mental health issues? Justify your response.

Recommended Reading

Janicke, D., & Hommel, K. (Eds.) (2016). Special Section: Cost effectiveness and economic impact of pediatric psychology interventions. *Journal of Pediatric Psychology, 41*, 831–902.

Miller, G., Chen, E., & Cole, S.W. (2009). Health psychology: Developing biologically plausible models linking the social world and physical health. *Annual Review of Psychology, 60*, 501–24.

Suls, J., & Rothman, A. (2004). Evolution of the biopsychosocial model: Prospects and challenges for health psychology. *Health Psychology, 23*, 119–25.

An Introduction to Body Systems and Psychological Influences on Health

Blaine Ditto

Learning Objectives

In this chapter you will:

- Learn the basic functions of key body systems.
- Discover how these body systems work together to support behaviour and health.
- Explore some of the ways these systems malfunction and produce disease.
- Be introduced to how the brain, behaviour, and psychological processes influence risk for disease.

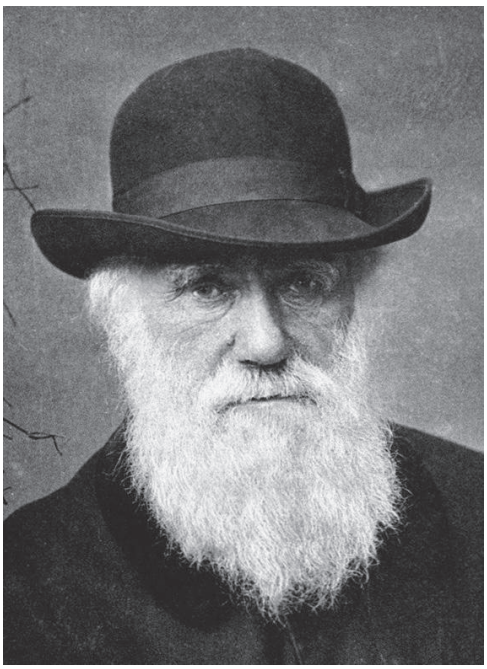
Body Systems

Introduction

Imagine you're a single-celled organism floating in a primeval sea. Life is good! The warm sun stimulates cellular activity and food is plentiful. On the other hand, things aren't perfect. Without a means of locomotion, you rely on currents and waves to make contact with food. Your ability to avoid becoming someone else's food is also limited.

There are problems with this fanciful scenario, including the fact that without a central nervous system you have no organ with which to consider these issues. However, the example raises several issues, including the origin of the field of health psychology. Biological structures and processes evolved because they allowed animals to *do* things that increased their chances of survival and reproduction, such as obtain food and avoid predators. This went beyond the development of simple structures such as legs to complex nervous systems that could support perception, evaluation of the environment, decision making, and emotion. In a sense, Charles Darwin (1872) became the first health psychologist when he suggested that emotional reactions such as fear and anger are the product of evolution and have widespread effects on behaviour and the body. Unfortunately, close integration of thought, emotion, and physiology cuts both ways. In the context of early evolution (or participation in the "Hunger Games"), emotions such as fear and anger increased one's chances of survival by motivating behaviour (e.g., to flee or fight), preparing the body for an emergency, and communicating one's situation to others by facial and bodily expression. On the other hand, in the modern world where vigorous physical reactions are usually unnecessary and most people die of chronic, degenerative illness, the wear and tear of these ancient responses has become a major source of illness (Sapolsky, 2004).

This chapter is an introduction to body systems and psychological influences on health. We begin with a brief overview of some of the body's major systems before introducing mechanisms of psychological influences on body function, such as the autonomic nervous system. The concept of stress is introduced (though discussed in more detail in Chapter 3), followed by some examples of stress-related illness. Throughout the chapter, the integration of psychological processes, physiological activity, and risk for illness is emphasized.



Charles Darwin (1809–82).

The Cardiovascular System

Complex multicellular organisms require some means of distributing nutrients internally since not all cells can be in contact with the environment. This was a crucial step in evolution, though different species developed different circulatory systems. For example, a number of species have more than one heart, for example, octopi have three and hagfish have five (Choy & Ellis, 1998).

In comparison, the human circulatory system (Figure 2.1) seems relatively simple and similar to closed-loop arrangements, such as a heating system, that circulate water. A strong central pump—the heart—maintains blood flow through a system of outgoing and incoming "pipes" (arteries, capillaries, and veins). Pressure in the system is higher after the heart beats and ejects blood (the systolic phase of the heart) compared

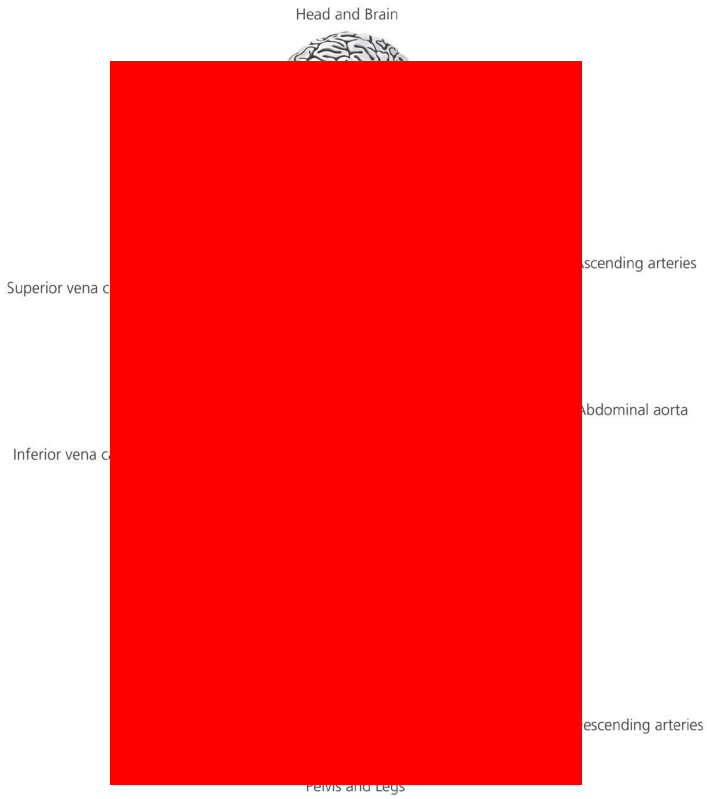


FIGURE 2.1 Schematic view of the cardiovascular system.

Source: Medical Artist Joanna Culley BA (Hons) MAA MIMI.

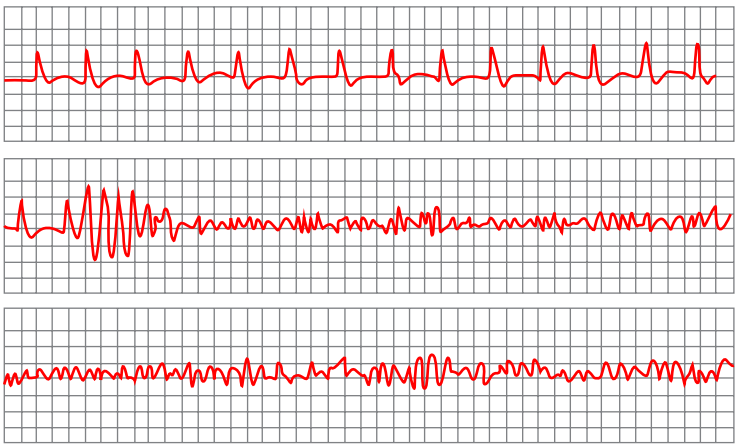


FIGURE 2.2 A normal electrocardiogram (heart rhythm), top, and two cases of ventricular fibrillation.

Source: Figure 3, pg 9 of Ventricular fibrillation is not provoked by chest compression during post-shock organized rhythms in out-of-hospital cardiac arrest, by Erik P. Hessa, Roger D. White, *Resuscitation*, Volume 66, No. 1.

to the resting phase (the diastolic phase), but in general flow is uninterrupted. The obvious importance of continual flow is indicated by what happens when the heart becomes an inefficient pump during a heart attack. Although there are some interesting exceptions (e.g., when someone falls in ice-cold water, slowing metabolism dramatically), death usually occurs within a few minutes in the absence of treatment. See Chapter 10 for a more detailed discussion of cardiovascular disease.

While the basic features are simple, the details of the cardiovascular system are complex and interesting. The human heart is actually two pumps side by side. Blood from the venous circulation collects in the right atrium and is ejected into the right ventricle. At the same time, blood that has just passed through the lungs collects in the left atrium and is ejected into the left ventricle. Afterward, simultaneous contraction of the right and left ventricles sends the blood out to the lungs and rest of the body via the aorta. These actions are co-ordinated by a repeated, reliable pattern of electrical activity that spreads from the atria to the ventricles. The activity associated with the contraction of the two atria is reflected as the P-wave in the electrical signature of the heart, the electrocardiogram (a normal rhythm is displayed in the top panel of Figure 2.2). Contraction of the more powerful ventricles is reflected by the R-wave (the large spikes in the top panel of Figure 2.2). Death of heart muscle cells as the result of a myocardial infarction can produce, depending on the area of cell death, various forms of fibrillation—an interruption of the smooth flow of electrical activity across the heart. This may cause the remaining cells to contract in an unco-ordinated fashion, decreasing the efficiency of the pump (bottom panels of Figure 2.2). Typically, defibrillation involves the use of a large shock in the hope of resetting the electrical profile of the heart.

In general, myocardial infarctions are the result of the process of atherosclerosis. That is, a number of stimuli such as cigarette smoke and high blood pressure can damage the interior lining of the arteries, the endothelium. This may lead to an excessive repair process involving **inflammation**,

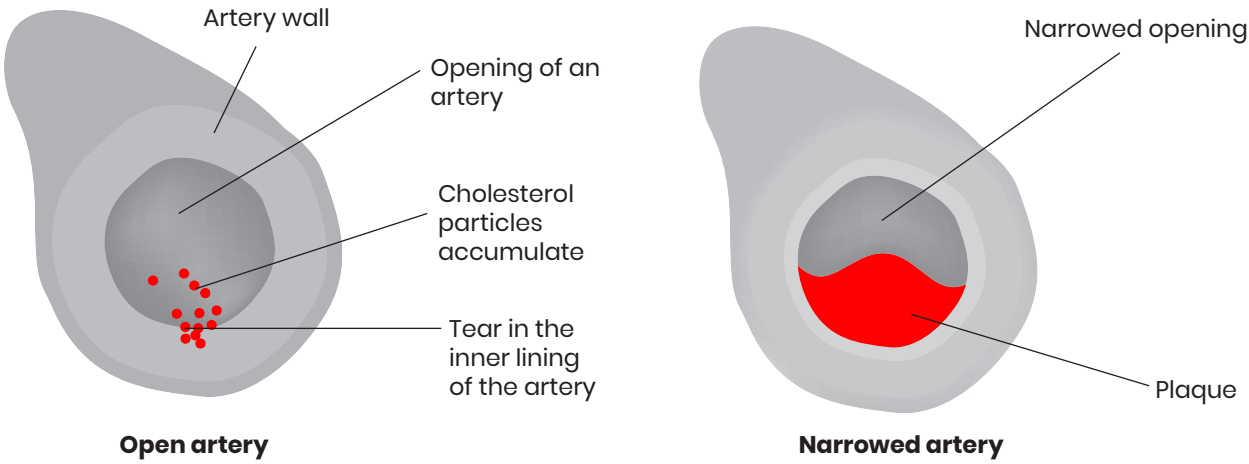


FIGURE 2.3 **The build-up of atherosclerosis in an artery.**

Source: Adapted from an image courtesy of http://www.virtualmedicalcentre.com/health-investigation/cholesterol-testing/65

clotting, cholesterol buildup, and eventually plaques that extend into the artery and reduce blood flow (Figure 2.3). Atherosclerosis can occur in any artery, but those that supply the heart muscle are especially important, given the body's dependence on the heart to distribute oxygen and nutrients.

As can be seen by the effects of wrapping a rubber band around your finger, pain is often experienced in areas of the body that have a reduction in blood flow. In the case of reduced blood flow to the heart, pain is often experienced in the form of angina, a pain or tightness in the chest or shoulder. Angina is an important though not universal warning sign of risk for myocardial infarction and fibrillation.

The Gastrointestinal System

The human body is often described humorously as a doughnut—its exterior surface includes an interior passage (Figure 2.4). That said, the movement of food through the gastrointestinal system is not a leisurely journey. Digestion transforms food using both mechanical and chemical processes to a form where nutrients can be easily absorbed. The breakdown begins in the mouth where it is chewed and mixed with

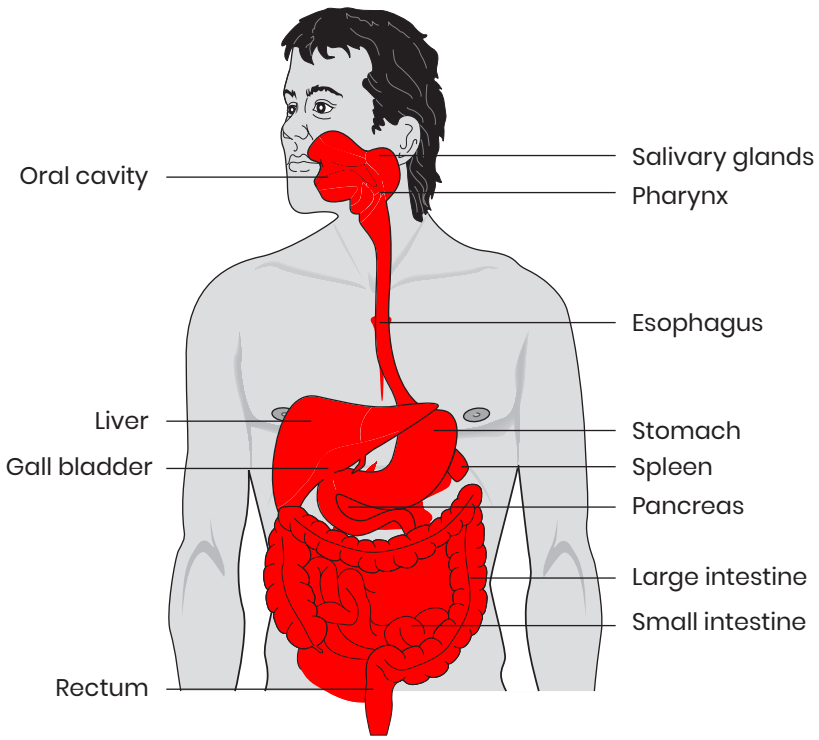


FIGURE 2.4 **The gastrointestinal system.**

Source: Adapted from an image courtesy of http://www.virtualmedicalcentre.com/anatomy/gastrointestinal-system/7

saliva. Patterned muscle contractions move the mixture through the esophagus to the stomach. Smooth muscle in the stomach contracts, further mixing food with corrosive substances such as hydrochloric acid. Additional materials from the liver and pancreas are added in the small intestine. Eventually, the component parts such as sugars and amino acids are small enough for absorption into capillary blood. Waste materials proceed through the large intestine.

This active process is monitored locally (e.g., more fat in the mixture will trigger release of the digestive fluid bile, originally produced by the liver, from the gallbladder into the small intestine) as well as by the brain. While most people acknowledge the influence of the brain on cardiovascular activity, the idea of central control of digestive activity is less appreciated. However, the involvement of muscle activity throughout the process suggests possible means of disruption and a mechanism for functional gastrointestinal disorders that some experience during stress. A more positive example is the increase in saliva often experienced in anticipation of a tasty meal. Some of the mechanisms of such control and their adaptive and maladaptive effects will be discussed below.

The Respiratory System

The respiratory system is also involved in bringing materials from the environment to cells deep within the body (Figure 2.5). Most animals require oxygen to utilize nutrients absorbed from the gastrointestinal system. Oxygen is required to convert glucose to the important molecule adenosine triphosphate, which, in turn, powers the body's chemical reactions. Carbon dioxide is a waste product of this process. Since both oxygen and carbon dioxide are gases, a different system for their intake and excretion was necessary. The primary organs in the respiratory system are the lungs. Other organs include the nose, mouth, trachea, and diaphragm. Similar to the cardiovascular system, air passes through progressively narrower passages in the lungs to allow efficient extraction of oxygen and uptake of carbon dioxide. At the end of the trachea, the pathway divides into two bronchi (the primary bronchi), one for each lung. After entering the lungs, the bronchi subdivide into secondary bronchi, bronchioles, and alveoli. Alveoli are small cavities surrounded by a mesh of capillaries. Carbon dioxide–rich blood from the venous circulation is pumped through the lungs by the heart's right ventricle. Carbon dioxide diffuses out into the alveoli, and oxygen from inspired air is absorbed and proceeds to the left atrium for circulation to the rest of the body. Air is moved in and out of the lungs primarily by contraction of the diaphragm located below the lungs.

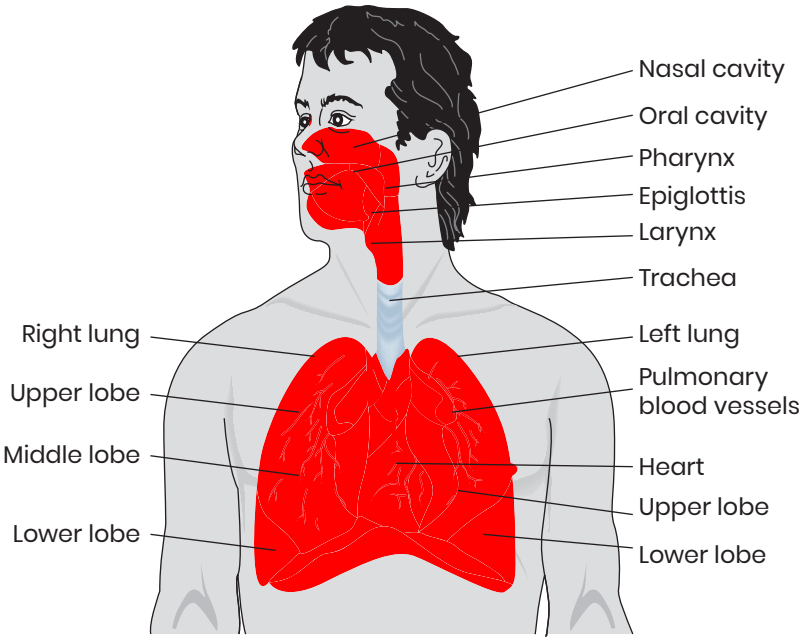


FIGURE 2.5 The respiratory system.

Source: Adapted from an image courtesy of http://www.virtualmedicalcentre.com/anatomy/respiratory-system/18

Although they require the activity of nearby muscles to move air in and out, the lungs are not simply passive bags of air. As in the gastrointestinal

system, the brain monitors the chemical composition of the blood and can speed or slow respiration via stimulation of the diaphragm. Smooth muscle cells surrounding bronchioles also control airflow. Degree of bronchodilation or constriction can be influenced by both the central nervous system and local processes if inspired air seems problematic, or in response to other environmental challenges.

The Renal System/Urinary System

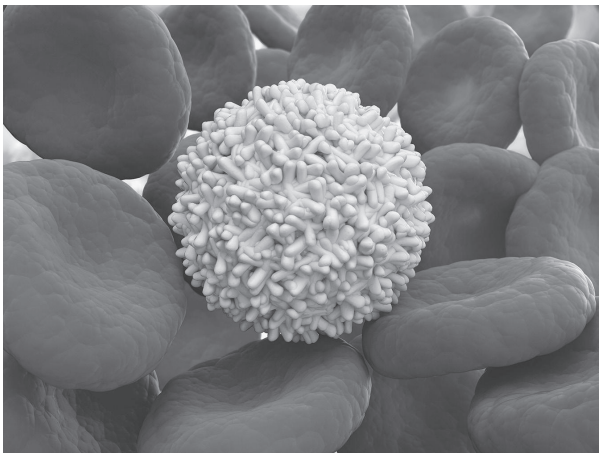
The gastrointestinal and respiratory systems are involved in both the intake of substances into the body and the removal of waste products, for example, carbon dioxide. The renal system also participates in waste removal as well as other processes such as blood pressure regulation. At any point in time, a considerable amount of the body's blood is being filtered in the two kidneys, the main component of the system. They remove waste products from the blood, concentrate urine that is subsequently passed through the urinary system, control the retention and excretion of electrolytes such as sodium and potassium, and are important in blood-pressure control. As a result, kidney disease can have widespread effects on the body.

The Immune System

As suggested by the previous discussion, a great deal of human physiology is involved in the intake and distribution of nutrients to cells in the interior of the body (this is not to imply that other systems, such as the reproductive system, are unimportant, but these will not be discussed here due to space limitations). Yet not everything that is eaten, inhaled, or otherwise enters the body is useful. Some substances, e.g., certain microorganisms, can be especially harmful. The **immune system** protects the body from infection.

The immune system is more diverse and much less compartmentalized than previously discussed systems. A widespread system is necessary given the diversity of ways that substances can enter the body. As a result, the primary components of the immune system are individual cells that circulate in the bloodstream, though there are also fixed components such as lymph vessels and nodes, the thymus, and the spleen.

Circulating leukocytes (i.e., white blood cells) develop from stem cells located in bone marrow. They have the potential to develop into many different kinds of blood cells and are initially distinguished into myeloid and lymphoid types. A number of different cells develop from the myeloid line, including some that are not part of the immune system such as oxygen-carrying erythrocytes (red blood cells) but also immune system components neutrophils, eosinophils, and macrophages (Figure 2.6). Most of these attack and digest suspect substances. Some also release substances to aid destruction and organize the immune response. For example, macrophages release molecules called cytokines, which activate other immune cells and promote inflammation.



Science Photo Library / Alamy Stock Photo

A white blood cell, or leukocyte.

Inflammation is a classic sign of infection. Cytokines and other inflammatory mediators such as histamine dilate and increase the permeability of blood vessels in the area, facilitating the influx of other immune cells attracted to the mediators. An increase in fluid in the area also causes

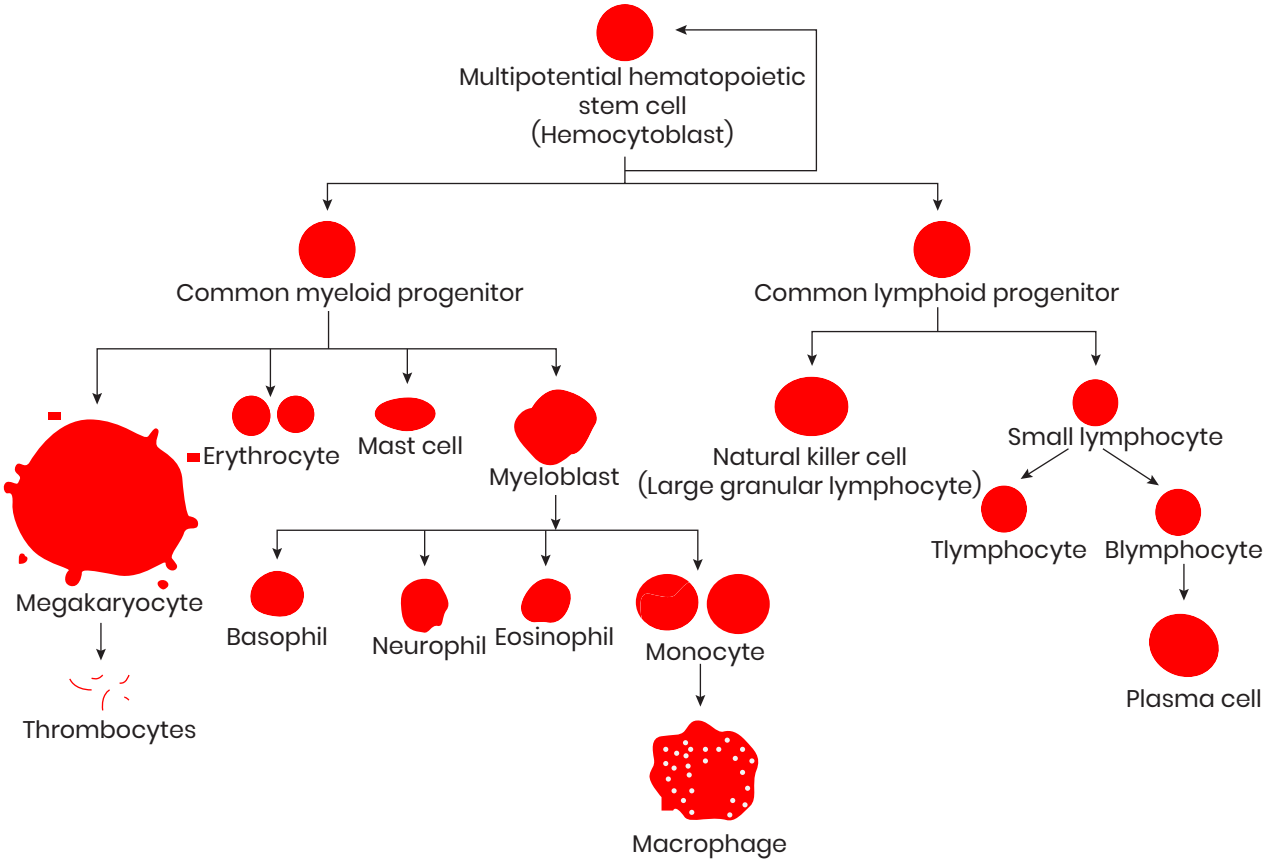


FIGURE 2.6 Circulating immune system cells.

Source: Mikael Häggström from original by A. Rad/Wikipedia.

it to balloon out, tightening connections between cells to create a physical barrier to isolate the infection. Red, puffy areas are a sign that the immune system is working.

Cells derived from the myeloid line as well as some from the lymphoid line (natural killer cells) provide what is described variously as natural, innate, or "non-specific" immunity. They are pre-programmed to attack many types of invaders by the presence of receptors that lock on to common proteins used by these bacteria, etc. However, this leaves open the possibility of attack by novel threats that may have developed recently, such as a new strain of the flu virus. "Specific" immune cells derived from the lymphoid line are more flexible in that they can be programmed to respond to protein patterns on new threats. Although this two-pronged system usually works well, it also means that specific immunity is ineffective during one's first encounter with the threat. For example, most people become quite sick when infected by the chickenpox virus the first time, though non-specific immune activity usually prevents death. However, lymphocytes are programmed to attack and remember the virus, thus providing more-or-less lifelong immunity after the initial infection.

Different types of lymphocytes have complementary functions and are classified as T or B cells (depending on where the cells mature) and subdivided into groups with the prefix CD (cluster of differentiation refers to molecules on cell surface). Cytotoxic T cells ($CD8^+$ cells) are

similar to neutrophils and macrophages in the sense that they directly attack dangerous cells, especially those infected with a virus. Other T cells support the immune response in various ways. For example, helper T cells ($CD4^+$ cells) stimulate cytotoxic T cells and macrophages by releasing cytokines. Although they do not attack cells directly, their importance is indicated by the devastating effects of the human immunodeficiency virus (HIV), which targets $CD4^+$ cells. B-lymphocytes play a key "humoral" support role, releasing antibodies that bind to invaders and attract immune cells.

The immune system developed to respond to a variety of threats. However, the process of detection is not perfect. At times, the system reacts to innocuous external and internal stimuli. Allergies are caused by unnecessary responses to innocuous external stimuli. Reactions are usually mild but can be life-threatening, as in the case of peanut allergy. The immune system can also attack healthy internal cells. Autoimmune disorders such as rheumatoid arthritis, type 1 diabetes, and lupus are caused by inappropriate targeting of healthy cells in the joints, pancreas, etc. To some degree, immune system cells are like a gang of hired gunslingers who generally follow orders but occasionally shoot the wrong person. Thus, there are mechanisms to dampen as well as stimulate immune activity, some of which involve central nervous system control mediated by actions of the **peripheral nervous system** and hormones. Central nervous system control of immune function will be discussed in the section on psychoneuroimmunology.

Psychological Influences on Body Systems

Complex organisms that could adapt to their surroundings were more likely to survive and produce offspring. The development of systems for the internal delivery of nutrients was a key step as this allowed other systems to execute behaviour. Nervous systems process information about the environment and internal condition of the body, adjusting physiology and behaviour accordingly. The human central nervous system can exert incredible control over physiology and behaviour via the peripheral nervous system and the **endocrine system**. Imagine the rapid-fire adjustments of muscle activity necessary to play a Mozart concerto (or at least to play it well)! At the same time, the brain has to adjust blood flow, respiratory activity, perspiration, etc. to support the behaviour.

Physiological activity is also adjusted according to internal as well as external sensory information. In addition to "efferent" fibres that transmit orders from the brain to muscles, the peripheral nervous system includes "afferent" fibres that transmit information from receptors sensitive to pressure, temperature, chemicals, and pain to the brain. A simple example is the baroreflex. To maintain adequate blood flow to the brain and reduce the chances of fainting as we move through daily activities, receptors sensitive to stretch are attached to the carotid arteries in the neck and elsewhere. If blood flow in this area goes down (e.g., if you stand up quickly), information is transmitted to the brain by afferent fibres in the glossopharyngeal nerve. This is combined with other information about the state of the cardiovascular system and organism, usually leading to compensatory cardiovascular responses organized by efferent fibres of the autonomic nervous system (discussed below), such as an increase in heart rate. The reverse—a decrease in heart rate—occurs when the arteries are stretched by an increase in blood pressure. Interestingly, external pressure to this area, such as wearing a tight collar or tie, can also produce a decrease in heart rate and, at times, fainting (for *Star Trek* fans, this is the origin of the Vulcan death grip). The baroreflex is a simple example of the continuous back-and-forth of information about the external and internal environment to the brain and adjustment of body function.

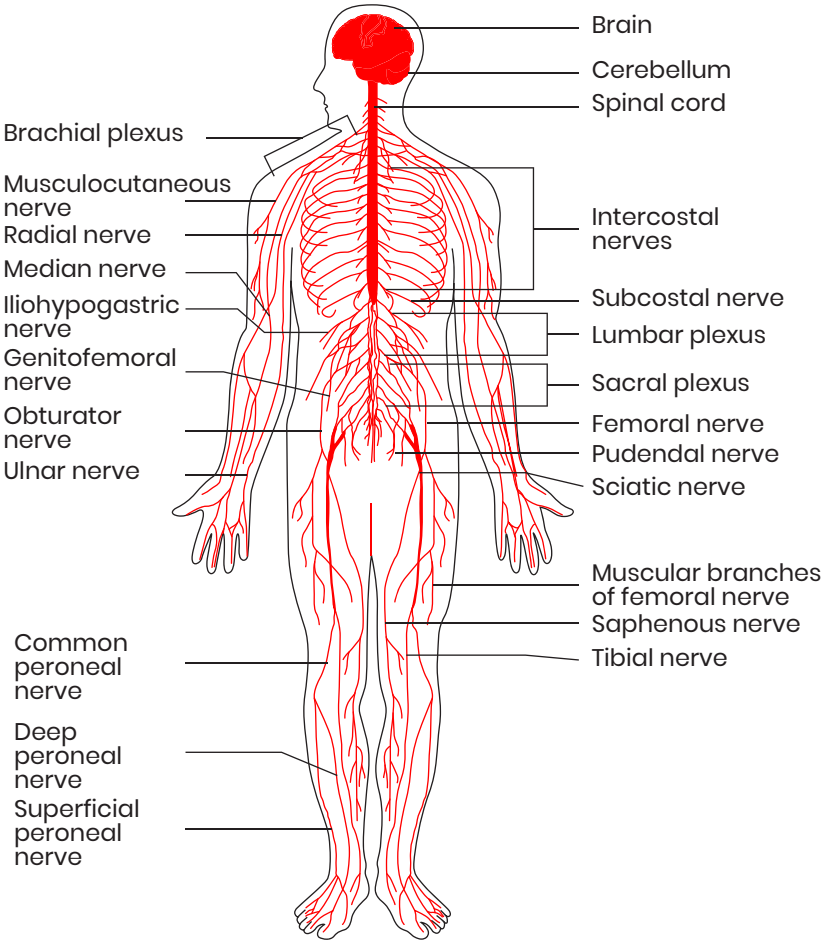


FIGURE 2.7 The peripheral nervous system.

The Peripheral Nervous System

The peripheral nervous system (Figure 2.7) allows the brain to make quick adjustments of body function. The central nervous system (CNS) is comprised of the brain and spinal cord. Neurons (i.e., nerve cells) of the peripheral nervous system are located outside the CNS. Fibres of the peripheral nervous system exit in bundles (nerves) from the brain stem or from the spinal cord between spinal vertebrae. Some fibres proceed directly to their "target organ" whereas others synapse with other neurons along the way in clusters called ganglia.

The peripheral nervous system has two subsystems—the **somatic nervous system** and the **autonomic nervous system**. The somatic nervous system consists of neurons that exit the spinal cord and proceed without synapse to striated muscle cells that control body movement, often referred to as voluntary muscle cells. As exemplified by the impact of severe spinal-cord injury, proper function of the somatic nervous system is important. If the spinal cord is severed due to an event such as car accident, the brain is unable to control somatic nervous system neurons that exit the spinal cord below the injury, resulting in paralysis of muscles innervated by those fibres. That said, since somatic nervous system neurons do not innervate organs such as the heart and the lungs, they are less important in terms of the major causes of illness. As a result, the autonomic nervous system will be described in greater detail.

The Autonomic Nervous System

The autonomic nervous system (ANS) consists of neurons that exit the brain stem or spinal cord, synapse with other ANS neurons, and proceed to cardiac muscle or smooth muscle cells that influence activity in different organs. Muscle activity influenced by the ANS is often referred to as "involuntary" since it occurs continuously without conscious thought, for example, you do not have to remember to tell your heart to contract. On the other hand, the word "involuntary" is somewhat inaccurate since the results of biofeedback experiments indicate that it is possible to develop some control over processes such as heart rate (Levenson & Ditto, 1981). Regardless, the ongoing nature of muscle tension means that ANS effects are revealed by increases and decreases in activity, such as increased or decreased heart rate, rather than the presence or absence of activity. It also means

that ANS activity affects muscle tension somewhat more slowly than somatic nervous system activity but has longer-lasting effects (imagine pushing a moving automobile as opposed to a stationary one).

Another similarity to automobiles is the fact that the ANS is subdivided into two relatively independent parts, similar to acceleration and braking systems (Figure 2.8). In general, the **sympathetic nervous system** (SNS) stimulates smooth muscle activity whereas the **parasympathetic nervous system** (PNS) usually inhibits activity.

The PNS is sometimes called the craniosacral system since these ANS fibres exit the central nervous system in the upper (cranial) and lower (sacral) regions. Typically, "pre-ganglionic" neurons proceed most of the way to their target organs before they synapse with "post-ganglionic" neurons. The post-ganglionic neurons are relatively short. Acetylcholine is used as the neurotransmitter at the junctions of the pre- and post-ganglionic PNS neurons and at the junctions between post-ganglionic PNS neurons and the target organ.

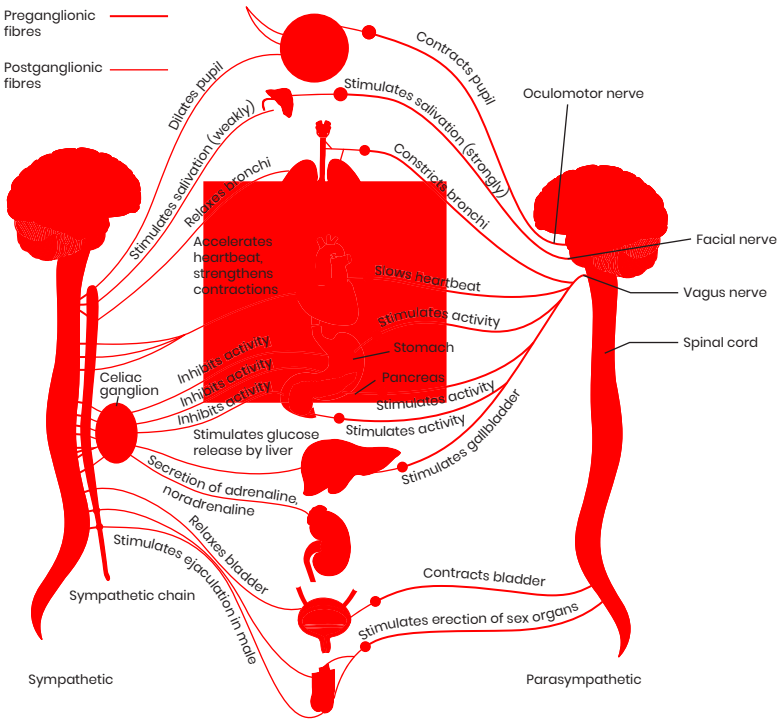


FIGURE 2.8 **The autonomic nervous system.**

The SNS is sometimes called the thoracolumbar system since these fibres exit the spinal cord in the central thoracic and lumbar regions. In contrast to the PNS, these pre-ganglionic neurons do not travel far before synapsing in large clumps called sympathetic ganglia, which are located close to the spinal cord. As a result, the post-ganglionic neurons of the SNS are much longer. As in the PNS, acetylcholine is used as the neurotransmitter at the junctions of the pre- and post-ganglionic SNS neurons, whereas norepinephrine is used as the neurotransmitter at the junctions between post-ganglionic SNS neurons and the target organ.

These differences in anatomy influence function. Though slower and less precisely targeted than somatic nervous system activity, PNS activity is generally quicker and more specific than SNS activity. There is much greater opportunity for sympathetic activity to spread and linger compared to parasympathetic activity. Imagine walking down a deserted street late at night. Unexpectedly, a cat knocks over a trashcan. Sympathetic activity will probably lead to a number of different responses—increased sweating, heart rate, constriction of blood vessels, etc.—that may leave you feeling "wired" for some time. Another interesting example has to do with nicotine. Nicotine from cigarette smoke stimulates a subtype of receptor for acetylcholine that is found in the brain and peripheral nervous system. This might suggest that nicotine produces physiological relaxation, consistent with the subjective experience of many smokers. However, since acetylcholine is also used as a transmitter in sympathetic ganglia, nicotine is mostly a stimulant in terms of its effects on peripheral physiology. Exceptions to this "all-or-nothing" description of SNS activity will be discussed later.

The Endocrine System

In addition to the peripheral nervous system, the brain can influence body function by stimulating the release of hormones. Hormones are similar and in some cases identical to neurotransmitters released by neurons of the peripheral nervous system and influence different aspects of target organ function. However, since they are released into the bloodstream they can influence physiological activity longer. The effects of hormones complement and extend peripheral nervous system activity. This is especially the case for hormones released from the central portion of the **adrenal glands**, the adrenal medulla (Figure 2.8). The adrenal medulla is somewhat unusual in that release of its hormones, primarily epinephrine and norepinephrine, is controlled by sympathetic nervous system fibres. SNS activity stimulates the adrenal medulla to release epinephrine and norepinephrine into the bloodstream, reinforcing and maintaining SNS activity.

Most other hormones are controlled by the hypothalamus and the pituitary gland, often referred to as the "master gland" (Figure 2.9). Descending activity from the brain stimulates different patterns of hypothalamic output to the pituitary. Neurons connecting the hypothalamus to the posterior portion of the pituitary gland control release of hormones such as antidiuretic hormone, which influences water retention by the kidneys and blood pressure, and oxytocin. Traditionally, oxytocin was viewed primarily in terms of its effects on reproductive activities, though more recently it has also been found to have stress-buffering properties. In fact, Taylor et al. (2006) have suggested that oxytocin is a key component of a motivational system ("tend and befriend") promoting social engagement to address collective needs, including safety and protection.

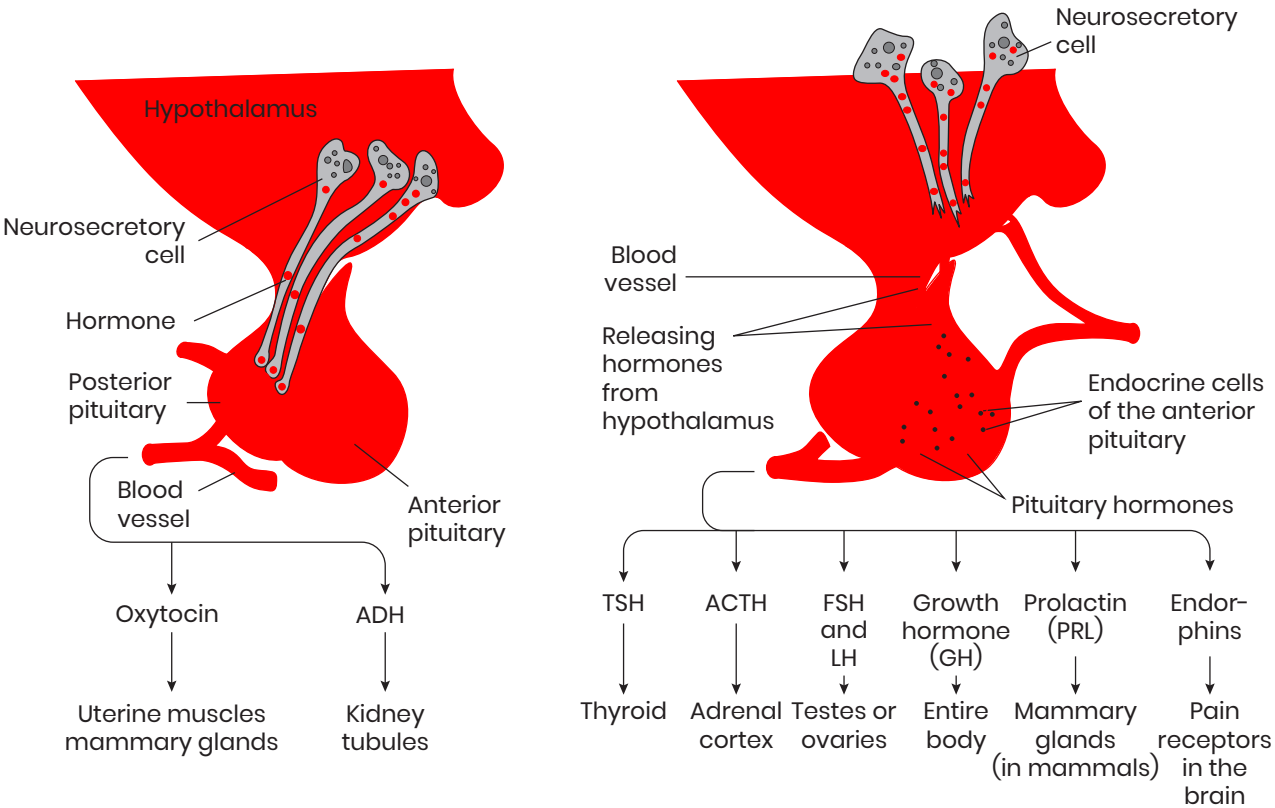


FIGURE 2.9 Pituitary hormones.

The anterior pituitary releases a wider array of hormones than the posterior pituitary and functions somewhat differently. The primary function of hormones released from the anterior pituitary is to stimulate the release of hormones from more distant glands. For example, thyrotropic hormone is released to control the thyroid gland. As well, the hypothalamus controls anterior pituitary function by secreting its own set of "releasing factors," that is, hormones that travel the short distance to the anterior pituitary to influence function. For example, hypothalamic gonadotropin-releasing factor controls the release of pituitary hormones regulating the gonads (testes and ovaries). Similarly, corticotrophin-releasing factor (CRF) controls the release of adrenocorticotrophic hormone (ACTH) from the anterior pituitary, which in turn regulates the adrenal cortex.

The hypothalamic-pituitary-adrenal (HPA) axis is especially important vis-à-vis psychological influences on body systems and the development of illness. The adrenal cortex releases a number of hormones, including glucocorticoids, mineralocorticoids, androgens, and estrogens. As the name suggests, mineralocorticoids (e.g., aldosterone) affect mineral balance (e.g., sodium) and often reinforce the effects of stress on variables such as blood pressure. Glucocorticoids (e.g., cortisol) free up glucose and other energy resources during times of stress. While this may be useful in some circumstances it can pose problems in others. Glucocorticoids also influence inflammation and other aspects of immune system activity that may have beneficial effects in some circumstances and adverse effects in others. This will be discussed in the section on psychoneuroimmunology.

The Development of the Stress Concept

The brain strives to maximize the efficiency of body function and adjust to the environment. Typically, adjustments are small and involve specific aspects of ANS or hormonal activity. For example, standing up may produce a brief decrease in baroreceptor stimulation that triggers an increase in cardiac-related SNS activity and a decrease in cardiac-related PNS activity (causing an increase in heart rate), but not much else occurs in terms of ANS or hormonal activity.

However, the brain also responds to stimuli that challenge the entire human organism. Stimuli such as extreme cold or heat, exercise, and blood loss elicit complex, widespread patterns of ANS and hormonal activity to prepare the body for different challenges. In the early 1900s, the physiologist Walter Cannon noted many common features of responses to strong, challenging stimuli, including stimuli primarily psychological in nature. In his classic book, *Bodily Changes in Pain, Hunger, Fear, and Rage* (1929), he argued that we possess a broad pattern of response to threat that he called the "fight-or-flight response pattern." Cannon believed that the extensive connections of the sympathetic nervous system allow the brain to prepare the body for a potentially life-threatening situation. SNS activity during a fight-or-flight response increases heart rate to facilitate delivery of nutrients to the muscles. It also constricts blood vessels in the skin and gastrointestinal system, though SNS activity *dilates* vessels supplying large muscles in the arms

"It was the classic fight or flight response. Next time, try flight."

In Focus

Cannon and "Voodoo Death"

Walter Cannon was a well-travelled man with diverse interests. Although not an epidemiologist (someone who studies disease trends in human societies) or an anthropologist, Cannon became fascinated by examples of death that seemed to be linked to extreme stress in several non-Western societies. In particular, he was interested in a phenomenon he called "voodoo death," where someone died after being "cursed" by a religious leader. He collected records from adventurers, anthropologists, missionaries, and physicians in South America, Africa, Australia, the Caribbean, and elsewhere. Given the unusual nature of the events, these were case reports rather than controlled experiments, but they were often quite detailed and allowed him to discount alternative explanations such as murder by poison or intentional suicide. Occasionally, Cannon was able

and legs. The fact that SNS activity stimulates smooth muscle in some blood vessels and relaxes it in others shows that the view of the SNS as producing uniform "arousal" is oversimplified. The SNS produces a pattern of peripheral physiological activity that prepares the body for vigorous physical action. Some processes are stimulated; others are inhibited. SNS activity also inhibits smooth muscle contraction in the gastrointestinal system (though this may disrupt digestion) and the bronchioles of the lungs (to allow greater intake of oxygen). The impact of the fight-or-flight response—more commonly described today as the stress response—on a wide variety of body functions has become increasingly recognized and now extends to aspects of physiology once believed unaffected, such as immune function.

Cannon was not an epidemiologist and thus did not extensively study associations between the fight-or-flight response and illness (an interesting exception was his study of the extreme example of voodoo death; see In Focus box, above). World events in the 1930s and 1940s also slowed appreciation of his work (Cannon had an interesting life that included rescuing scientists in the turmoil of the Spanish Civil War and World War II). However, interest in the topic of stress skyrocketed after World War II. To a large degree, this was due to the physician and researcher Hans Selye. Similar to Cannon, Selye believed that a wide range of stimuli can elicit a pattern of physiological activity—the stress response—that is problematic in modern life. His focus on the effects of stress on hormonal activity, particularly the adrenal hormone **cortisol**, complemented Cannon's interest in the ANS. As a physician, he was also more focused on how stress contributed to disease and was noted for his work linking stress, cortisol, and ulcer formation in rats. Selye's greatest contribution, though, may have been to popularize the idea of stress in the scientific community and the general public. His classic book, *The Stress of Life* (1956), was read widely largely because it argued that stress is a daily occurrence. This idea struck a chord in the years of the Cold War and, more generally, during an era of growing concern about the effects of industrialization, the growth of suburbs, and the "rat race" of modern, Western human life. Selye's message fit the times and provided a boost to stress research and the development of health psychology.

to correspond with the observer to extend his detective work.

Cannon viewed voodoo death as essentially the flip side of the placebo effect—a powerful effect of expectation on health. However, in this case, the expectation was death, leading to intense fear and a self-fulfilling prophecy of "death from fear" (Cannon, 1942). In addition to cultural beliefs, this was usually accentuated by withdrawal of all social support and acceptance of the victim's fate by others. Although he could not examine the victims directly, Cannon suggested that strong sympathetically mediated blood vessel constriction was the key feature of the process. Reports of looking extremely pale and "white as a sheet" were common. He believed that this led eventually to a state of physiological shock not unlike a wartime injury. It is likely that other processes were involved, such as cardiac arrhythmias (Sternberg, 2002), but this was an early, creative attempt to link life stress, emotion, physiological activity, and health.

Theories of stress and coping will be discussed in Chapter 3. For the moment, the only issue to note before turning to a few examples of stress-related illness is the association between stress and emotion.

Emotion

Although Cannon and Selye emphasized the idea of a broad, generic stress response, subsequent research revealed interesting differences as well as similarities in reactions to many strong stimuli, including emotional stimuli. These findings complement rather than undercut the notion of a stress response since the differences usually seem to match the nature of adaptive behaviour most likely to occur in the situation. However, the precise pattern of the stress response is more tailored to the situation than once believed. One of the most important differences concerns reactions to situations that elicit anger as opposed to fear. Both being in an angry confrontation and walking on a deserted street late at night, for example, can elicit large increases in heart rate mediated by an increase in SNS activity and decrease in PNS activity directed at the heart. However, anger-inducing situations are more likely to elicit sympathetically mediated blood vessel constriction than are fear-inducing situations, which may even elicit vasodilation (Ax, 1953; Sinha, Lovallo, & Parsons, 1992). This may be due to the fact that the odds of an angry confrontation leading to physical aggression, injury, and blood loss are much greater (at least in an evolutionary context) than a fearful situation that encourages you to run. Blood vessel constriction might reduce blood loss due to injury.

Differences in stress responses may set the stage for different stress-related disorders and be part of the reason that not everyone suffers from a stress-related illness. For example, the development of stress-related hypertension appears to be associated with a certain type of stressful life environment and emotional predisposition that, along with genetic susceptibility, increases risk for high blood pressure. This idea of environmental and emotional patterning will be elaborated in the discussion of specific illnesses.

The fact that emotions are the immediate stimulus for many stress reactions raises one other important issue. Stress responses do not require actual exposure to challenging life situations.

Strong reactions can be produced by the anticipation of an event that may never occur or the memory of an event that has already occurred. This may have been a useful conservative error at one time in evolutionary history (better safe than sorry that one hasn't anticipated and prepared for an attack), but it leads to even more unnecessary stress responses involving, for example, irritation of arteries by increased blood pressure.

Psychological Factors in the Development of Medical Illnesses

Without question, environmental challenges or "stressors" can influence body function. However, can the stress response actually make you sick? Since human beings are not assigned randomly to stressful and non-stressful circumstances at birth, this question has always been controversial. A number of different approaches have been employed, often blending human and animal research. These are illustrated in the following discussion of several stress-related disorders.

Gastrointestinal Ulcers: Executive Monkeys and Helpless Rats

Historically, gastrointestinal ulcers were viewed as the prototypic stress-related illness. In the middle of the twentieth century, many believed that the pressures of modern life and business contributed to the development of ulcers, especially among people with executive responsibility. This belief was common in scientific circles (based largely on Selye's research) as well as the popular media (e.g., the high-pressure newspaper editor in the Spider-Man comics, J. Jonah Jameson, had an ulcer).

In addition to stereotypes of the time, the idea was boosted by an influential experiment that seemed to confirm the importance of executive stress. The "executive monkey" experiment (Brady, Porter, Conrad, & Mason, 1958) was one of the most widely cited studies in psychology and a staple of introductory psychology textbooks for decades (see also Chapter 3). In this study, monkeys trained to avoid the delivery of electric shocks by pressing a bar were much more likely to develop ulcers compared to control monkeys who were placed in the same environment and received the same number of shocks but were not given this "responsibility." Unfortunately, the experiment had a crucial flaw that was not appreciated for some time. To save time during initial training, monkeys who learned the desired behaviour quickly were non-randomly assigned to be executives! The other monkeys were assigned to be the controls. As a result, ulcer formation in the executives may have been due to pre-existing differences in activity, fearfulness, or sensitivity to pain.

The executive monkey study is a useful cautionary tale of the dangers of uncritical adoption of stereotypes and over-enthusiasm for the idea that stress causes illness. However, it does not imply that stress cannot cause illness, including gastrointestinal ulcers. In fact, subsequent animal research showed that certain stressful situations reliably increase risk for ulcers. Weiss (Weiss, Pohorecky, Salman, & Gruenthal, 1976) conducted a well-known series of more tightly conducted studies with rats and found that animals placed in the more helpless situation of receiving electric shocks that they were unable to control were more susceptible to ulcers. Unpredictability also increases risk. The similarity between these animal experiments and the learned helplessness paradigm of psychological depression is obvious, and a number

of unpleasant, uncontrollable situations have been found to induce ulcers in animals. For example, simply restraining rats for long periods of time significantly increases risk for ulcers. Underscoring the association with depression, recent research indicates that the likelihood of restraint-induced ulcers in rats is reduced by the anti-depressive medication fluoxetine (Prozac) (Abdel-Sater, Abdel-Daiem, & Sayyed Bakheet, 2012). Another interesting finding from Weiss's experiments (Weiss et al., 1976) was that rats exhibiting signs of aggression towards another rat when shocked were significantly *less* likely to develop lesions, even if this did nothing to terminate the shocks. This is an interesting contrast to research that will be discussed below indicating the importance of anger and aggression in the development of cardiovascular disease. In sum, there is good evidence that uncontrollable stress can contribute to gastrointestinal ulcers in animals.

However, the field took another unexpected turn in the 1980s in the context of human research on ulcers. Two Australian researchers, Barry Marshall and Robin Warren, discovered that a bacterium, Helicobacter pylori (H. pylori), was present in many ulcer patients and that antibiotic treatment often produced remarkably beneficent effects. This led some to argue that the problem was essentially "solved" and that even if stress could produce ulcers in animals it was irrelevant for human ulcers. On the other hand, while the importance of H. pylori continues to be acknowledged, views have become more nuanced in recent years. For example, about 30 per cent of people with ulcers do not have H. pylori and ulcers sometimes reoccur in people treated for H. pylori despite elimination of the bacterium. Most important, most people with H. pylori do not develop ulcers (Fink, 2011). Thus, it is more accurate to view it as a strong risk factor for ulcers that can be exacerbated by other factors, including stress. An interesting study found that stomach ulcers increased significantly following the Hanshin-Awaji earthquake of January 1995 in Japan, especially among those most personally affected and less able to rebuild (Aoyama et al., 1998). Another large population-based study found an association between personality disorders and stomach ulcers (Schuster, Limosin, Levenstein, & Le Strat, 2010). Levenstein (2000) developed a model that integrates influences of infection, stress, and lifestyle factors such as smoking and alcohol use on ulcer formation. The idea that stress may contribute to ulcer formation by reducing immune activity is consistent with the growing area of psychoneuroimmunology. It is also consistent with the role of depression, which is known to have a particularly strong effect on cortisol release. Thus, after some interesting twists and turns, there has been a revival of interest in the role of stress in gastrointestinal ulcers that reflects the growing sophistication of stress research. Indeed, study of stress-gastrointestinal connections will likely grow considerably in coming years given developments in understanding of the extent and diversity of microorganisms that reside within the gastrointestinal system, referred to collectively as the microbiome. The effects of the microbiome include both negative and positive influences on physiology and health that extend far beyond the gastrointestinal system to even the brain (Sherwin, Rea, Dinan, & Cryan, 2016).

Vasovagal Reactions: A Brief but Dramatic Response

Most people are familiar with the symptoms of a vasovagal reaction (VVR), often through personal experience, even if they are unfamiliar with the term. Many people experience dizziness, weakness, and even fainting at some point in their lives that is not due to an external insult such as concussion or drug use or internal disease such as epilepsy. Vasovagal reactions are caused by a decrease in blood flow to the brain in the absence of other illness. Historically, this was believed to

be due to the combined effects of a large decrease in heart rate (mediated by parasympathetic *vagal* activity) and changes in blood vessel constriction. This description is not incorrect, though more recent research suggests that blood vessel constriction in the brain may be especially important (Folino, 2006). If blood flow to the brain is reduced sufficiently, fainting or "vasovagal syncope" occurs.

Fortunately, the majority of faints are brief and do not require treatment, though injury from falling is not unusual and longer faints can lead to seizures and on rare occasions death. Fainting and milder symptoms are also associated with avoidance of health-care behaviour such as injections and dental exams as well as clinical phobias. As a result, vasovagal reactions are more serious than the comic depictions of a Victorian matron who swoons at the receipt of bad news or a cartoon character who faints when startled. In fact, a vasovagal reaction is probably the clearest, most dramatic example of stress-related illness. In the span of a few moments, an individual with no pre-existing illness can be rendered *unconscious* by a psychological stressor.

Similar to some early views on the development of stress-related ulcers, vasovagal syncope was first thought to be the result of a stress-related parasympathetic rebound—essentially a side effect of "relief." In a classic article, Graham (Graham, Kabler, & Lunsford, 1961) noted that vasovagal symptoms during injections and blood draws generally follow a period of strong sympathetic nervous system activity and often occur towards the end of the procedure, sometimes after removal of the needle. On the other hand, though a full discussion of the psychology and physiology of the vasovagal response is beyond the present scope, the idea of relief is inadequate. For example, students rarely faint at the end of exams! This does not seem to be a general response to the termination of a stressful event. Nor is there a general association with anxiety or fear. For example, among people with strong fears, a number of studies have showed that people with blood, injury, and injection phobias are especially susceptible to vasovagal reactions whereas people who might have extreme fears of animals or social situations are no more likely to faint than people in the general population. Ost (1992) found that 70 per cent of people with blood phobias had fainted at least once during their lives. Vasovagal reactions seem to be related to the anticipation of physical harm.

In some respects, this sounds similar to the situation that sets the stage for stress-related ulcers, though there are differences as well. In particular, people do not faint or get dizzy in the context of every unpleasant, uncontrollable situation. As suggested above, there seems to be a special association with having to endure "puncture" in the context of injections, blood draws, and dental work. Another clue may be the fact that postural stress such as standing contributes significantly to risk for vasovagal symptoms. This has been observed even in people who are otherwise extremely healthy, such as young soldiers required to stand at attention for a long time (Fitch & Rippert, 1992). Finally, the vasovagal reaction is virtually identical to the physiological response to severe actual blood loss. In fact, hemorrhage-related fainting is observed reliably across species when blood loss approaches 30 per cent of total volume.

Diehl (2005) proposed that hemorrhage-related fainting developed as an active, adaptive response to severe injury. Some aspects of sympathetic activity are stimulated to increase perspiration and blood vessel constriction near the surface of the body. However, other aspects of sympathetic activity are decreased and some aspects of parasympathetic activity are increased in an attempt to lower blood pressure and thus blood loss. Lower blood pressure leads to less blood loss from a wound and greater opportunity for clotting. Metabolic activity is also reduced if this leads to loss of consciousness. This may also be a convincing way to "play dead" in the presence of a predator or overwhelming opponent (Bracha, 2004). Regardless,